

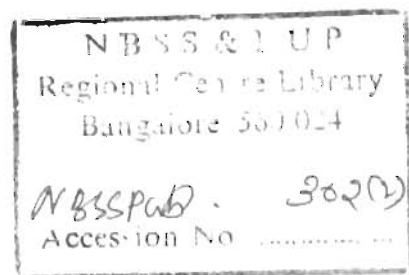
LAND USE PLANNING OF UDAIPUR DISTRICT SOIL RESOURCE AND ECOLOGICAL ASSESSMENT

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ABOUT THE NBSS & LUP

The National Bureau of Soil Survey and Land Use Planning (NBSS & LUP), Nagpur, a premier Institute of the Indian Council of Agricultural Research (ICAR), was set up in the year 1976 with the objective to prepare soil resource maps at state and district level and to provide research inputs in soil resource mapping, and its applications, land evaluation, land use planning, land resource management, and database management using GIS for optimising land use on different kinds of soils in the country. The Bureau has been engaged in carrying out agro-ecological and soil degradation mapping at the country, state and district level for qualitative assessment and monitoring the soil health towards viable land use planning. The research activities have resulted in identifying the soil potentials and problems, and applications of the soil surveys with the ultimate objective of sustainable agricultural development. The Institute is also imparting in service training to staff of the soil survey agencies and SAU's in the area of soil survey and land evaluation, soil survey interpretations for land use planning, remote sensing applications to soils and agriculture, and GIS for land resource management. The Bureau in collaboration with Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola is running post-graduate, teaching and research programme in land resource management, leading to M.Sc. and Ph.D. degrees.

The publication on **"Land use Planning of Udaipur District - Soil Resource and Agro-ecological Assessment"** is prepared using the data base generated during Soil Resource Mapping. It will help in optimal utilization of soil resources and suggesting options for effective land use.

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FOREWORD

India is endowed with vast natural resources of land, water, vegetation and climate, yet controlled with poor quality of life. Notwithstanding natural resource endowments, population offsets the advantages. Burgeoning population of the country may stabilize around 1.4 billion by 2025 and 1.6 billion in the year 2050 requiring annually 380 and 450 million tonnes of food grain, respectively against the current production of 202.53 million tonnes. Besides meeting the food grain needs, the agricultural needs of 676 million tonnes of dry forage for cattle and 46 million m³ of fuel wood by 2020 are exorbitantly high. A demand driven population pressure calls for quantum jump in production from the almost stagnant net sown area of 142.2 million ha.

Soil is the most vital natural non renewable resource whose proper use greatly determines the capability of life support system and the socio-economic development of any nation. A knowledge of soil in respect of their extent, distribution, characteristics, use potential and their limitations is therefore, extremely important for optimizing land use. It is also well known that the soil productivity is closely related to the inherent soil characteristics which are influenced by climate, environmental features and geographic position. Hence the basic task of a soil survey organization assumes mammoth importance in that it establishes a basic framework for efficient land use and monitoring the health of diverse soils. The research and agricultural predictions depend on site specific information on soils.

Natural resource survey provides basic data on land resources. The interpretation of such data has immense importance to planners and decision makers for proposing sustainable land use plan. In view of this, an attempt has been made to interpret the soil resource data base of Udaipur district in the bulletin entitled, **“Land Use Planning of Udaipur District – Soil Resource and Agroecological Assessment”**. It provides soil map of the district consists of 28 mapping units as association of dominant (average 60% area of mapping unit) and subdominant (average 40% area of mapping unit) soil families with phases such as soil depth, texture, slope, erosion, salinity and sodicity etc. The attempt has also been made to provide soil and site suitability for principle crops of the district.

It is hoped that the publication will be useful to researchers, policy makers, developmental agencies, environmentalists and all those interested in the conservation, improvement and efficient utilization of soils in the district.

I appreciate the efforts made by the team of Scientists under the leadership of Dr. K.S. Gajbhiye, Director in bringing out this publication, and I congratulate them for the endeavour.

(J.S. Samra)

Deputy Director General (NRM)
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PREFACE

National Bureau of Soil Survey and Land Use Planning has brought out many soil survey reports and maps ever since its inception in 1976. One of the common suggestions from many quarters has been to simplify these reports for easy understanding and its use for planning and developmental activities. In view of this, a decision was taken to generate different theme maps based on soil resource data base as per the priority and the needs of different user agencies so that the resource data are put to use for developmental works.

Soils, as we all know, are basic to our very existence. It is an outcome of the interaction of several factors and processes acting on base rock as conditioned by relief over a period of time. Since it takes hundreds of years to form a centimetre of soil, it is imperative to conserve it for prosperity. This can be achieved, provided we all, understand the nature and behaviour of soils, and the implications of their irrational use.

Land use, though, is everybody's concern who wants to live with aesthetic sense yet unmindfully deprived of the benefits of it due to ignorance. Towards this objective Regional Center, Udaipur of NBSS&LUP has made an attempt to bring out the publication on ***"Land Use Planning of Udaipur District- Soil Resource and Agro-ecological Assessment"***. The interpretation of such data has immense importance to planners and decision makers for proposing sustainable land use plan. In view of this, an attempt has been made to propose scientific land use of Udaipur district. The district has total geographical area of 14.62 lakh ha and constitutes 4.27% area of the state of Rajasthan. It receives an average rainfall of 650 mm. The potential evapotranspiration is 1380 mm. Precipitation is greater than 0.5 PET for 90-105 days. The length of growing period in a year is 90-135 days. Major part of district is hilly and unculturable (34.3%). It has forest in 27.7% and pasture in 6.3% area. The culturable waste is 8.9 percent. The fallow land constitutes 6.8 percent area.. The area under crops constitute to 16 percent of the district.

It is hoped that the publication will be useful to researches, policy makers, developmental agencies, environmentalists and all those interested in the conservation, improvement and efficient utilization of the soil resources for sustainable land use.

The efforts made by the team of Scientists under the leadership of Dr. R.L. Shyampura, Principal Scientist and Head, Regional Centre, Udaipur in bringing out this publication is very much appreciated.

(K.S. Gajbhiye)
Director, NBSS & LUP
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This publication "Land use Planning of Udaipur district – Soil Resource and Ecological Assessment" is the outcome of collective efforts of many officials of the National Bureau of Soil Survey and Land Use Planning. The support and cooperation of the following persons is gratefully acknowledged in bringing out the publication.

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EXECUTIVE SUMMARY

Natural resource survey provides basic data on land resources. The interpretation of such data has immense importance to planners and decision makers for proposing sustainable land use plan. In view of this, an attempt has been made to propose scientific land use of Udaipur district (23°50' and 25°05'N latitude and 73°05' and 74°40'E longitude). It has total geographical area of 14.62 lakh ha and constitutes 4.27 percent area of Rajasthan. It receives an average rainfall of 650 mm. The potential evapotranspiration is 1380 mm. Precipitation is greater than 0.5 PET for 90-105 days. The length of growing period in a year is 90-135 days. Major part of district is hilly and unculturable (34.3%). It has forest in 27.7 percent and pasture in 6.3 percent area. The cultural waste occupies 8.9 percent. The fallow land constitutes 6.8 percent area. The area under crops constitute to 16 percent of the district.

Soil map of Udaipur district consists of 28 mapping units as association of dominant (average 60% area of mapping unit) and subdominant (average 40% area of mapping unit) soil families with phases such as soil depth, texture, slope, erosion, salinity and sodicity etc. The thematic maps for depth, texture, slope, erosion and salinity etc. have been generated depicting features of dominant and subdominant soil attributes highlighting physiography at tehsil level.

Inceptisols (Haplustepts) and Entisols (Ustorthents) are dominantly observed covering 47.0 and 18.4 percent area respectively. Vertisols (Haplusterts) and Alfisols (Haplustalfs) occupy minor area and constitutes 2.7 and 3.7 percent area of the district. About 50 percent area is medium to fine textured with depth exceeding 50 cm. The very shallow to shallow soils are 19 percent. The moderately shallow to moderately deep soils are 43.9 percent. The deep soils are 8.9 percent. Steep slope, strong stoniness and skeletal soils constitute to 16 to 20 percent area of the district. About 39 percent area is severely eroded. Rock outcrops are mainly associated with shallow, skeletal, coarse loam to loam soils having moderate to strong stoniness, gentle to steep slope and severe erosion. Valley portion in between hillocks are predominantly shallow to moderately shallow, loam to fine loam with gentle to moderate erosion. ER upland plains are moderately deep to deep, fine loam to clayey, slight to moderate erosion. Around 12 percent area of the district is affected by slight to moderate salinity and sodicity problem in pockets predominantly in Vallabhnagar and Sarada tehsil. Water erosion problem is severe in eastern Rajasthan upland plain. Besides rock outcrops about 19.8 percent area has AWC <50 mm. The area of 32.5 percent and 15.3 percent have AWC 50-100 mm and 100-150 mm respectively whereas 4.0 percent area of district has AWC between 150-200 mm. Valley soils in between rock outcrops have AWC between 100-150 mm in dominant soils and 50-100 mm in associated soils. Soils of Vallabhnagar and part of Mavli tehsil have AWC between 150-200 mm.

Organic carbon is low in 34.3 percent, medium in 20.1 percent and high in 17.2 percent soils of Udaipur district. Associated soils with rock outcrops are medium to high and intensively cultivated soils are low to medium in organic carbon. Available nitrogen is low in 80 percent soils whereas available

phosphorus is medium and available potassium is high. Available micronutrient (Zn, Mn, Cu, and Fe) is high except pockets of low to marginal available copper (5.4%) and available iron (13.9%).

Agro-ecological unit (AEU) map of Udaipur district has been prepared by super imposing the variability of rainfall (10 cm) and LGP (15 days) on soil map on 1:250,000 scale and 28 soil mapping units have been delineated as 72 agroecological units. They are described in terms of soil site characteristics, rainfall, length of growing period, available water capacity and assessed for their suitability for different crops. Land capability classification show 25.8 percent and 24.8 percent area under LCC II and III (Good to moderate) suitable for cropping. In Aravalli region 44.7 percent area is under class II and III whereas in ER Upland 95.1 percent area is under class II . These areas can be considered as potential areas for cropping. Distribution of irrigation capability class of soils shows 50.5 percent area good to moderate ICC 2-3 and 3.9 percent area marginally suitable (ICC 4) for irrigation.

Land suitability for different crops has been assessed by matching the characteristics of mapping units with crop requirements at different limitation level as suitable (S1), moderately suitable (S2), and marginally suitable (S3). Pulses (cowpea, moong, urd) and oilseed (sunflower, sesame and castor) have higher suitability than cereal (maize, sorghum, bajra). Suitability of ER upland region is higher as compared to Aravalli region. Valley soils are generally moderately suitable for rainfed crops. Associated soils with rock outcrops in Sarada, Girwa, Salumbar and Kherwara tehsil are moderate to marginally suitable for rainfed crops. Soils of Kherwara, Salumbar, Sarada, Gogunda and Girwa tehsil are moderately suitable whereas soils of Kotra and Jhadol tehsil are of low suitability.

Suitability of wheat, barley and mustard is almost same under irrigated condition in normal soil whereas barley and mustard has higher suitability in saline soils. Gram has relatively low suitability in soils of ER upland plain in Mavli and Vallabhnagar tehsil and part of Kherwara tehsil. Soils of Dhariawad, Gogunda, Sarada, Salumbar have moderate suitability. Valley soils are moderately suitable under irrigated condition for wheat, barley and mustard. Associated soils with rock outcrops in Salumbar, Sarada, Dhariawad and Girwa tehsil are moderately suitable for irrigated crops. Soils of Kherwara, Salumbar, Sarada, Gogunda and Girwa tehsil are moderately suitable whereas soils of Kotra and Jhadol tehsil are of low suitability.

The potentially suitable area for sorghum, oil seed crops (castor, sunflower) and pulses is higher as compared to maize. Introduction of these crops can increase cropped area substantially from the present 16.7 percent. There is not much scope for increasing the area in rabi. However, there can be shift from wheat to barley, mustard, gram and rabi pulses which have low water requirement as compared to wheat. In valley soils in Jhadol and Gogunda tehsil there is possibility of augmenting water resources through watershed development and creating water storage structures. Development of pastures and plantation in pockets in shallow skeletal soils and rock outcrops can substantially enhance the recharge of ground water.

INTRODUCTION

Soil resource survey provides the basic data on land. The interpretation of such data has immense importance for undertaking the activities connected with land use on sustainable basis. Identification and categorization of homogeneous agroecological zones is precursor for proper utilization of land, water and other related resources. Under the current scenario of soil resource constraints caused due to increasing population there is necessity for high priority micro level planning of the districts suggesting alternative land uses. In view of this, the information on soil resource of Udaipur district (1:250,000 scale) has been used to generate thematic maps and agroecological units for assessing crop suitability and suggesting land use for the benefit of decision makers and extension workers.

1.1 Location and Extent

Udaipur district is situated in the southern part of Rajasthan state and located between 23°50' and 25°05'N latitude and 73°05' and 74°40'E longitude. The total geographical area of the district is 14.62 lakh ha (4.27 % of the state). It lies at an elevation of 500 m above MSL generally increasing towards west. It abounds in hills, some are steep in the south west corner and wooded in northwest and south east. The northern portion is characterized by elevated plateau. The eastern portion is fertile plains. Main rivers of the district are the Banas, Berach, Som, Jakham, Sabarmati and Wakal.

The district is flanked by Dungarpur, Banswara, Chittorgarh, Rajsamand and Sirohi district of Rajasthan and Banaskantha district of Gujarat. It is administratively divided into ten tehsil (Fig. 1) viz. Dhariawad, Gogunda, Jhadol, Kherwara, Kotra, Mavli, Salumbar, Sarada, Girwa and Vallabhnagar. The district forms a part of Aravalli land scape. It is mainly discontinuous hilly tracts in south (87.8%) and upland (12.2%) in eastern part (Fig. 2). The eastern upland (ER upland) includes mainly Mavli and Vallabhnagar tehsil and formed by the older and recent alluvium laid by the Banas river system originating from the Aravalli range. The general gradient of the upland is towards east to south east. The geological formations are Aravalli metamorphics comprising micaschist, quartzite, dolomite, hornblende, schist, gneisses etc. Vegetation of the district belongs to tropical dry deciduous type. Total population of the district is 26.3 lakh including 46.2% scheduled tribes. Tribal population constitutes more than 50% in Dhariawad, Jhadol, Sarada, Kherwara, Kotra and Girwa tehsil.

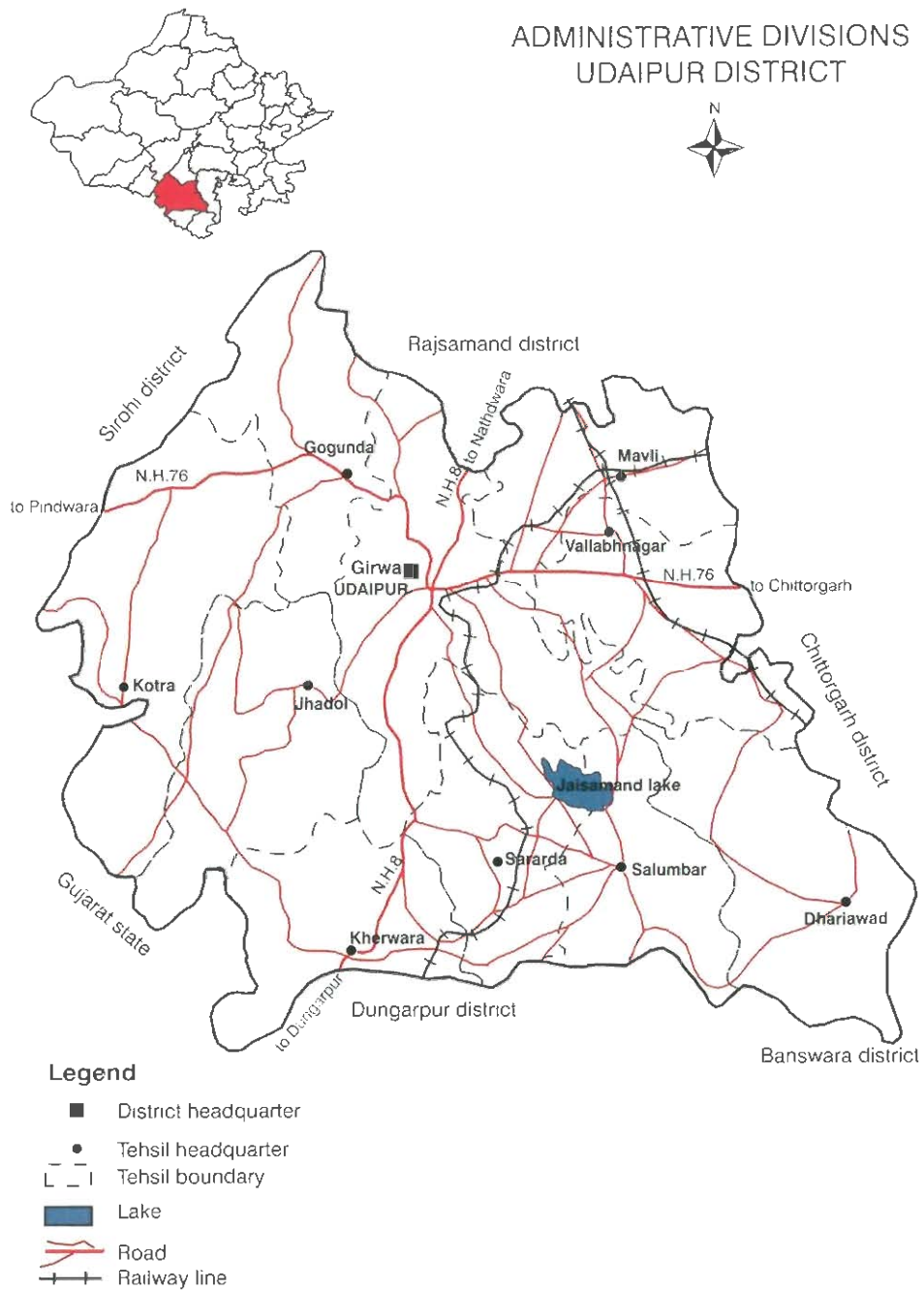


Fig. 1

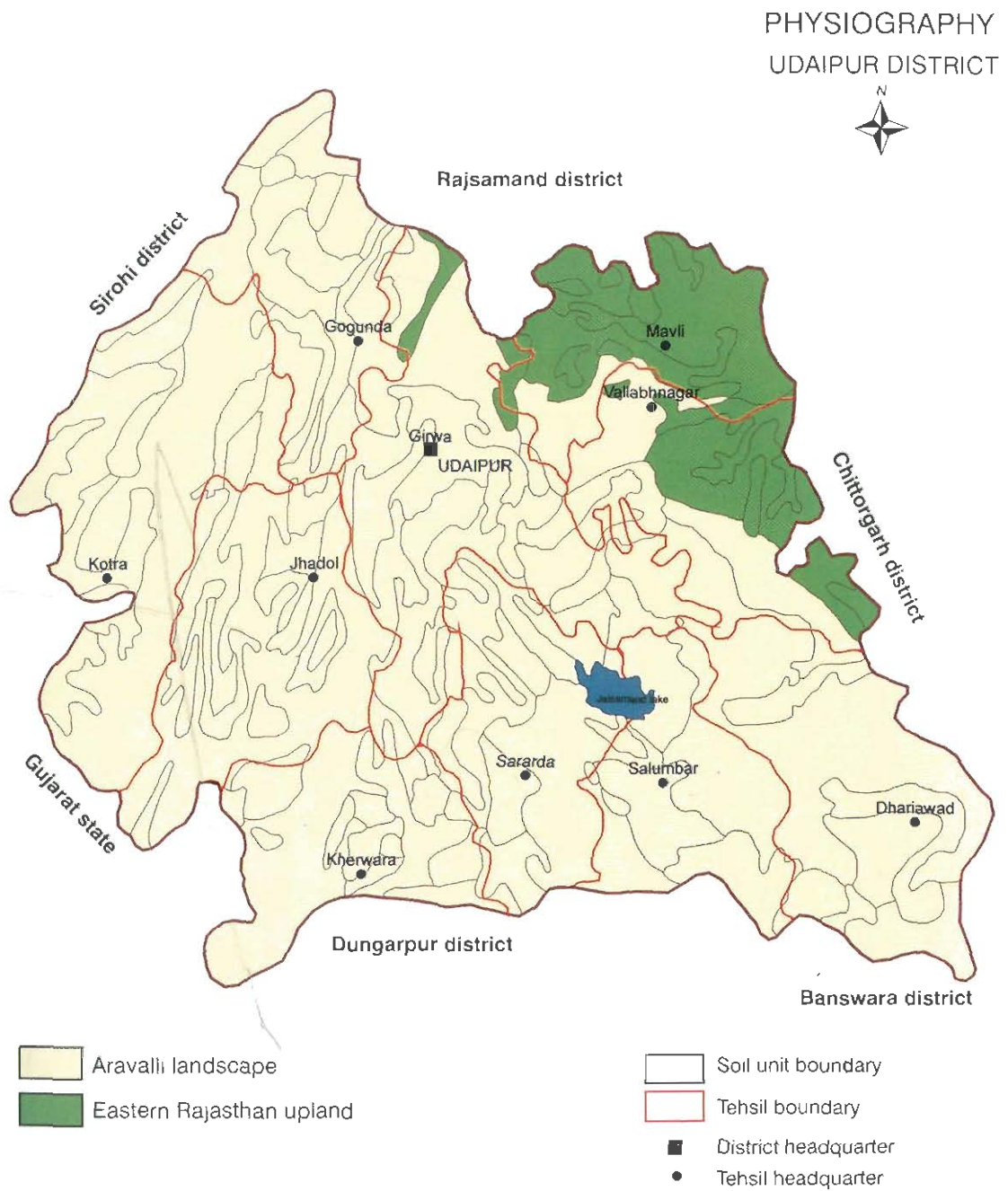


Fig. 2

1.2 Climate

The climate of the district (Table 1) is tropical semi arid characterized by dry hot summer and intense winter. The average rainfall is 650 mm. It ranges from 600-800 mm. It generally decreases from south-west to the north-east. Dhariawad, Kotra and Salumbar tehsil receives 700-800 mm rainfall. The remaining parts receives 600-700 mm rainfall (Fig. 3). On an average, the number of rainy days in a year are 31. The number varies from 21 around Mavli to 42 at Kotra. Of the total rainfall about 90-95 percent occurs during June to September, the maximum being in July. The variation in the annual rainfall from the year to year is large. Variability of 370 to 738 mm has been observed in between 1990 to 2004 with consecutive 4-5 dry weeks in four years and 2-3 dry weeks in three years.

The winter sets from December and continues to February. The hot season commences from March and ends with the middle of June. The monsoon season spread over mid June to mid September. January is the coldest month with mean daily maximum temperature at 24.20C and mean daily minimum at 7.80C. The minimum temperature some times reaches as to a freezing point and causes the frosts occasionally. The diurnal variation of temperature is large particularly in the winter and summer months.

May is the hottest month (38.60C). The summer is milder. The relative humidity varies between 40-80 percent. Average PET is 1380 mm. Water balance diagram of Udaipur, Kotra, Sarada and Kherwara indicates that the precipitation is found greater >0.5 PET for 90-105 days (Fig. 4). Length of growing period ranges from 90-120 days in a year. The soil moisture and temperature regimes are Ustic and Hyperthermic respectively.

Table 1. Climate of Udaipur

Month	Rainfall (mm)	Rainy days	Temp °C		RH (%)		Wind velocity (km/hr)	PET (mm)	0.5 PET (mm)
			Max.	Min.	Morning	Evening			
January	7.1	0.4	24.2	4.8	66	40	2.7	59	30
February	3.2	0.3	27.6	9.7	55	29	2.6	79	40
March	2.9	0.3	32.3	15.1	43	24	3.6	125	63
April	1.7	0.1	36.0	20.2	34	23	4.6	159	80
May	9.2	0.8	38.6	24.9	38	25	6.3	204	102
June	68.0	3.3	35.9	25.3	63	40	7.4	179	90
July	228.9	10.3	30.7	23.9	78	70	6.3	120	60
August	204.9	8.9	29.3	32.9	81	75	4.7	102	51
September	107.9	4.9	30.9	22.1	76	65	3.7	115	58
October	1.0	0.7	32.0	18.9	62	42	2.3	112	56
November	4.5	0.7	29.1	11.0	57	39	1.5	71	36
December	12.0	0.2	26.3	8.3	63	40	4.5	55	28
Annual	650.2	30.5	31.1	17.5	60	43	3.9	1380	694

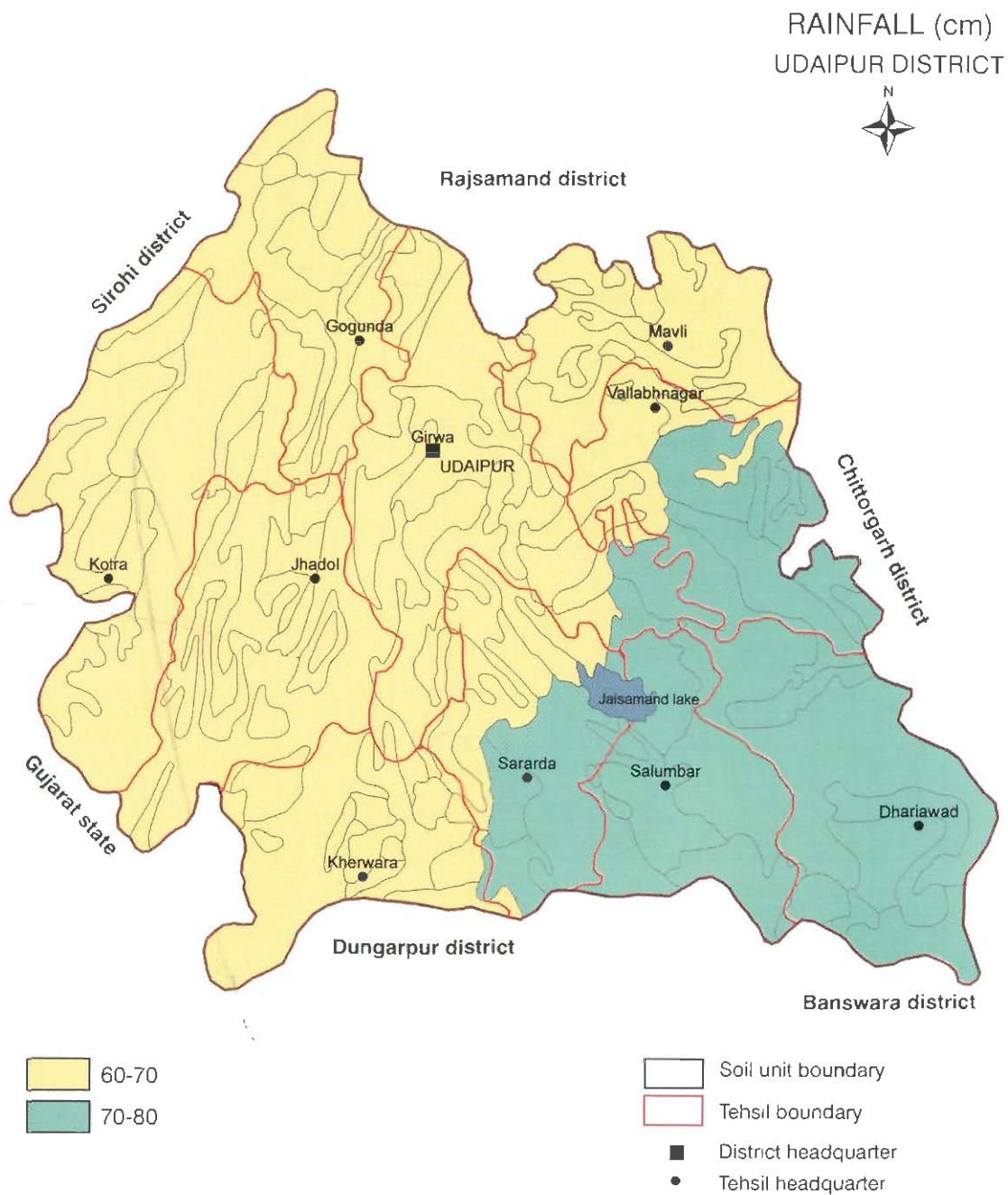


Fig. 3

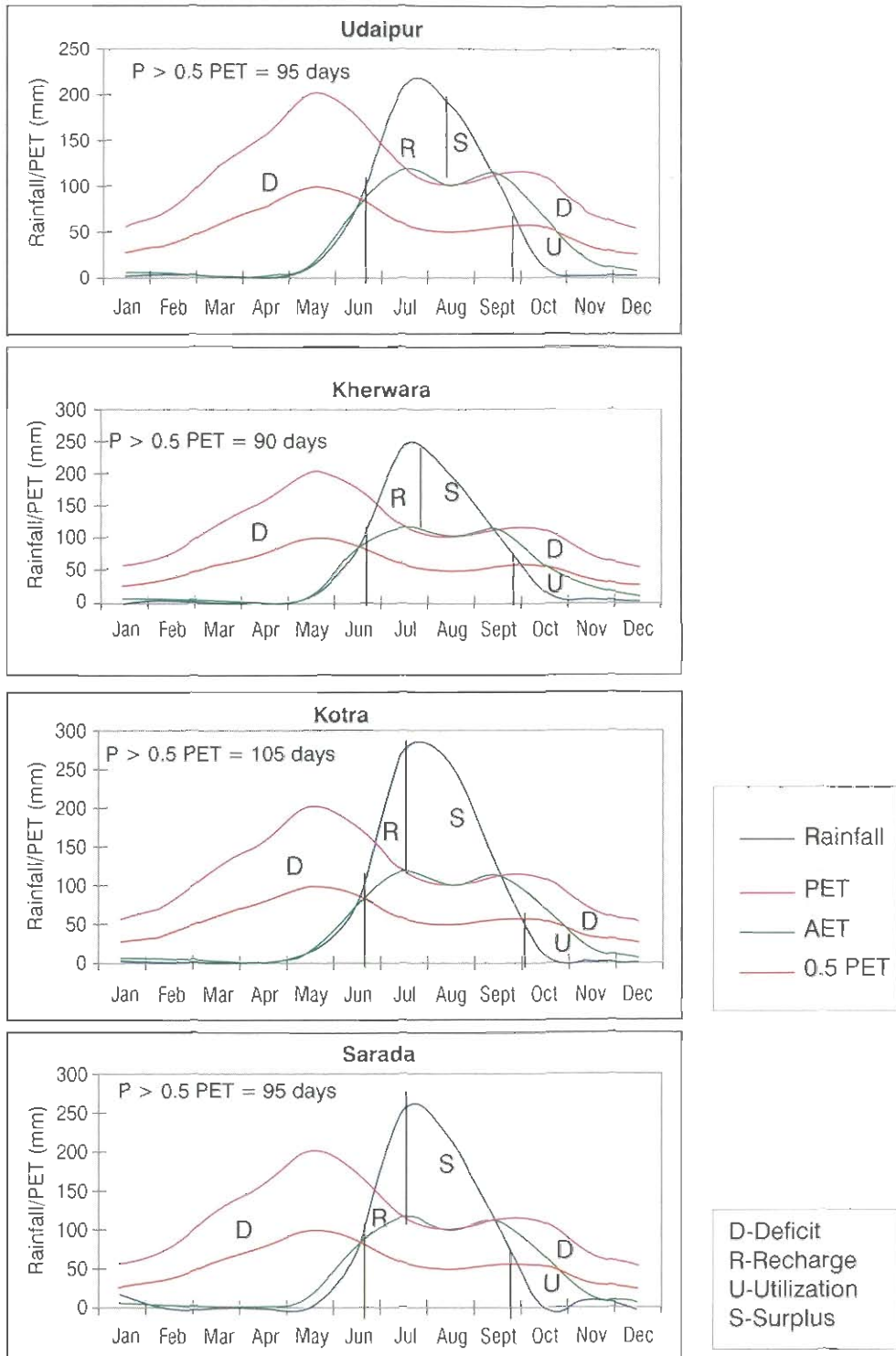


Fig. 4 : Water balance diagram of Udaipur district

1.3 Land Use

Of the total area (14.6 lakh ha) the hill and unculturable area occupy 34.3 percent, forest by 27.7 percent, pasture by 6.3 percent, culturable waste by 8.9 percent and fallow land by 6.8 percent (Table 2). Forest area constitutes major land use in Kotra (67.9%) and Jhadol (53.7%) tehsil. The forest in Dhariawad, Gogunda, Kherwara and Girwa tehsil constitutes to 20-30 percent area. Due to hilly land formation of Aravalli region unculturable land is high in Sarada (67.4%), Girwa (42.3%) and Kherwara (30.9%) tehsil as compared to other tehsils (15-20%).

The area under different crop is constituted 16 percent. It is high in Vallabhnagar (36.3%), Mavli (33.8%) and Dhariawad (26.5%) tehsil. The area constituted to cropping to the extent of 10-20 percent in Gogunda, Jhadol, Kherwara, Salumbar and Girwa tehsil and <10% in Kotra and Sarada tehsil. Double crop area in the district goes upto 40-45 percent. However it declines to 25-30% in sub optimal rainfall year (drought year). Double crop area in normal rainfall year is 60-80% of crop area in Dhariawad and Salumbar tehsil, 40-50% in Gogunda, Jhadol, Sarada, Girwa and Vallabhnagar tehsil and around 30% in Kherwara, Kotra and Mavli tehsil. The area under irrigation is 7.7 percent, which constitutes 48% of crop area in normal rainfall year. Irrigated area declines by 40-50% in sub optimal rainfall years. Irrigated area constitutes 15-20% of total area in Dhariawad, Mavli and Vallabhnagar tehsil as compared to only <5% in Gogunda, Jhadol, Kherwara and Kotra tehsil.

Table 2. Land use Udaipur district (2000) (Area in ha)

S. No.	Tehsil	TGA *	Forest	Unculturable land	Pasture	Culturable waste	Fallow	Crop area
1	Dhariawad	120940	34250	25936	10709	11650	6210	31995
2	Gogunda	90773	28436	15981	9703	18039	6619	11953
3	Jhadol	144100	77402	30320	4717	3986	9070	18605
4	Kherwara	110211	26828	34095	8355	6961	12813	21161
5	Kotra	242237	164415	42253	5565	3695	7458	18851
6	Mavli	82912	330	12871	9714	21903	10096	27998
7	Salumbar	151343	10780	83099	8617	12569	12206	24066
8	Sarada	227704	23357	153413	6676	14099	12220	17939
9	Girwa	188746	37892	79766	14600	18854	13640	23841
10	Vallabhnagar	103143	649	24179	12963	18320	9120	37478
	Total	1462109	404349	501913	91619	130066	99452	233887

* Total Geographical area

During the period of 1990 to 2000, there is decline in net sown area from 260000 to 234000 ha and increase in fallow from 70000 to 99000 ha. Area under forest, cultivable waste and pasture has remained fairly constant. Area irrigated from wells have shown a trend of increase whereas area irrigated from canals have significantly declined. The kharif maize is predominant crop (60-70%) followed by kharif pulses (15-25%). The major rabi crops are wheat, mustard, barley and gram.

2.1 Soil Resource Mapping

Based on 3 tier approach, landform analysis, field surveys, correlations and laboratory analysis, soil map of Rajasthan was generated at 1:250,000 scale and printed on 1:500,000 scale. There are 375 soil mapping units (soil family association). Each map unit represents the association of dominant and subdominant soil families representing 60 and 40% area respectively. Map legend elucidates information on soil order, suborder, great group, subgroup including soil depth, particle size class of the control section, texture of surface soil, slope, erosion class. Soil map of Udaipur district (Fig. 5) represent 28 mapping units. The legend (Table 3) depicts major characteristics of each polygon (mapped soil).

Table 3. Soils of Udaipur district

Map Unit	Brief Description	Taxonomy (Sub-group)	Area (ha) (%TGA)
Central highland Aravalli landscape			
170	Rock outcrops ; associated with shallow, well drained, loamy skeletal soils, severely eroded and strongly stony.	Rock outcrops Lithic Ustorthents	419000 (28.63)
172	Rock outcrops; associated with moderately shallow, well drained, fine loamy soils on gently sloping foot slopes, severely eroded.	Rock outcrops Typic Haplustepts	253300 (17.30)
174	Rock outcrops; associated with moderately shallow, well drained, loamy skeletal soils on moderately steeply sloping side slopes, severely eroded and strongly stony.	Rock outcrops Aridic Haplustepts	7800 (0.53)
175	Shallow, well drained, loamy soils on gently sloping foot slopes with loamy surface, moderately eroded and moderately stony; associated with rock outcrops.	Lithic Ustorthents Rock-outcrops	9700 (0.66)
176	Very shallow, well drained, loamy skeletal soils on very steeply sloping side slopes, loamy surface, severely eroded and strongly stony; associated with very deep, well drained, coarse loamy soils on very gently sloping foot slopes, moderately eroded.	Lithic Ustorthents Typic Haplustepts	44500 (3.04)
182	Very shallow, well drained, loamy skeletal soils on steeply sloping side slopes with loamy surface, severely eroded; associated with moderately shallow, well drained, loamy skeletal soils on pediments, very severely eroded.	Lithic Ustorthents Typic Ustorthents	4500 (0.31)

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193	Moderately shallow, well drained, fine loamy soils on gently sloping pediments with loamy surface, severely eroded; associated with moderately shallow, well drained, coarse loamy soils, severely eroded.	Typic Haplustepts Typic Haplustepts	29600 (2.02)
199	Moderately shallow, well drained, fine loamy soils on gently sloping pediments with loamy surface, moderately eroded; associated with moderately shallow, well drained, loamy skeletal soils, severely eroded and moderately stony.	Typic Haplustepts Typic Ustorthents	12500 (0.85)
207	Very shallow, well drained, loamy skeletal soils on moderately sloping pediments with loamy surface, severely eroded, strongly stony; associated with moderately deep, well drained, fine loamy soils moderately eroded.	Lithic Ustorthents Typic Haplustepts	9600 (0.65)
208	Very shallow, well drained, loamy skeletal soils on moderately sloping pediments with loamy surface, severely eroded, strongly stony; associated with shallow, well drained, loamy soils, severely eroded moderately stony.	Lithic Ustorthents Lithic Ustorthents	9506 (0.64)
209	Deep, well drained, fine loamy soils on gently sloping pediments with loamy surface, severely eroded; associated with moderately shallow, well drained, fine loamy soils, severely eroded.	Typic Haplustepts Typic Haplustalfs	1800 (0.11)
220	Deep, well drained, coarse loamy soils on gently sloping plains with loamy surface, severely eroded; associated with rock outcrops.	Typic Haplustepts Rock outcrops	24800 (1.70)
226	Moderately shallow, well drained, fine loamy soils on gently sloping plains with loamy surface, moderately eroded, slightly saline and moderately sodic; associated with moderately shallow, well drained, fine soils, slightly eroded, slightly saline and moderately sodic.	Typic Haplustepts Typic Haplustepts	73800 (5.04)
229	Moderately deep, well drained, fine loamy soils on gently sloping plains with loamy surface, slightly eroded; associated with very deep, well drained, fine loamy soils, slightly eroded.	Typic Haplustalfs Typic Haplustepts	21200 (1.45)
235	Very deep, well drained, coarse loamy soils on very gently sloping plains with loamy surface, moderately eroded; associated with very deep, well drained, calcareous, sandy soils, severely eroded.	Typic Haplustepts Typic Ustipsamments	4700 (0.31)
236	Moderately deep, well drained, fine loamy soils on gently sloping plains with interspersed hillocks, loamy surface, moderately eroded; associated with moderately shallow, well drained, fine loamy soils, moderately eroded.	Typic Haplustepts Typic Haplustalfs	105500 (7.20)
238	Moderately shallow, well drained, fine loamy soils on very gently sloping plains with interspersed hillocks, loamy surface, moderately eroded; associated with moderately shallow, well drained, calcareous, fine loamy soils, moderately eroded, moderately saline.	Typic Haplustepts Typic Haplustepts	36100 (2.47)
239	Moderately shallow, well drained, fine loamy soils on gently sloping plains with interspersed hillocks, loamy surface, moderately eroded; associated with moderately shallow, well drained, coarse loamy soils, severely eroded.	Typic Haplustepts Typic Haplustepts	66100 (4.51)

240	Very shallow, well drained, loamy skeletal soils on moderately steeply sloping side slopes with loamy surface, severely eroded; associated with moderately deep, well drained, fine loamy soils on gently sloping plains, moderately eroded.	Lithic Ustorthents Typic Haplustalfs	4000 (0.27)
241	Moderately deep, well drained, fine loamy soils on gently sloping plains with interspersed hillocks loamy surface, moderately eroded; associated with very shallow, well drained, loamy soils on moderately sloping side slopes, severely eroded.	Typic Haplustepts Lithic Ustorthents	61200 (4.18)
242	Moderately shallow, well drained, fine loamy soils on gently sloping plains with rolling hillocks, loamy surface, moderately eroded; associated with very shallow, well drained, loamy skeletal soils on rolling hillocks, severely eroded.	Typic Haplustepts Lithic Ustorthents	79800 (5.45)
Eastern Rajasthan Upland			
243	Moderately shallow, well drained, fine loamy soils on very gently sloping plains with interspersed monadnocks, loamy surface, slightly eroded, moderately saline and sodic; associated with moderately deep, well drained, coarse loamy soils, moderately eroded.	Typic Haplustepts Typic Haplustepts	27900 (1.90)
244	Deep, well drained, calcareous, fine loamy soils on very gently sloping plains with interspersed monadnocks, loamy surface, moderately eroded; associated with moderately shallow, well drained, fine loamy soils slightly eroded, moderately saline, slightly sodic.	Typic Haplustepts Typic Haplustepts	19700 (1.35)
245	Deep, well drained, fine soils on gently sloping plains with interspersed monadnocks having clayey surface, moderately eroded; associated with deep, well drained, fine soils slightly eroded, moderately saline, slightly sodic.	Vertic Haplustepts Typic Haplusterts	98600 (6.73)
247	Deep well drained, coarse loamy soils on very gently sloping plains with interspersed monadnocks having loamy surface, slightly eroded; associated with deep well drained, fine loamy soils, moderately eroded.	Typic Haplustepts Typic Haplustepts	8900 (0.61)
265	Moderately shallow, well drained, calcareous, fine loamy soils on very gently sloping plains with interspersed monadnocks, loamy surface, slightly eroded; associated with moderately shallow, well drained, calcareous, fine loamy soils, moderately eroded strongly saline, slightly sodic.	Typic Ustorthents Typic Haplustepts	19500 (1.33)
267	Moderately deep, well drained, calcareous fine soils on very gently sloping plains with interspersed monadnocks, clayey surface, slightly eroded; associated with deep, well drained, calcareous, fine soils, slightly eroded.	Typic Haplustepts Vertic Haplustepts	1400 (0.09)
299	Moderately shallow, well drained, fine loamy soils on very gently sloping foot slopes with loamy surface, moderately eroded; associated with with moderately deep, well drained, calcareous, sandy soils, severely eroded.	Typic Haplustalfs Typic Ustipsamments	2400 (0.16)
	Waterbodies (Tanks, lakes etc.)		6100 (0.42)

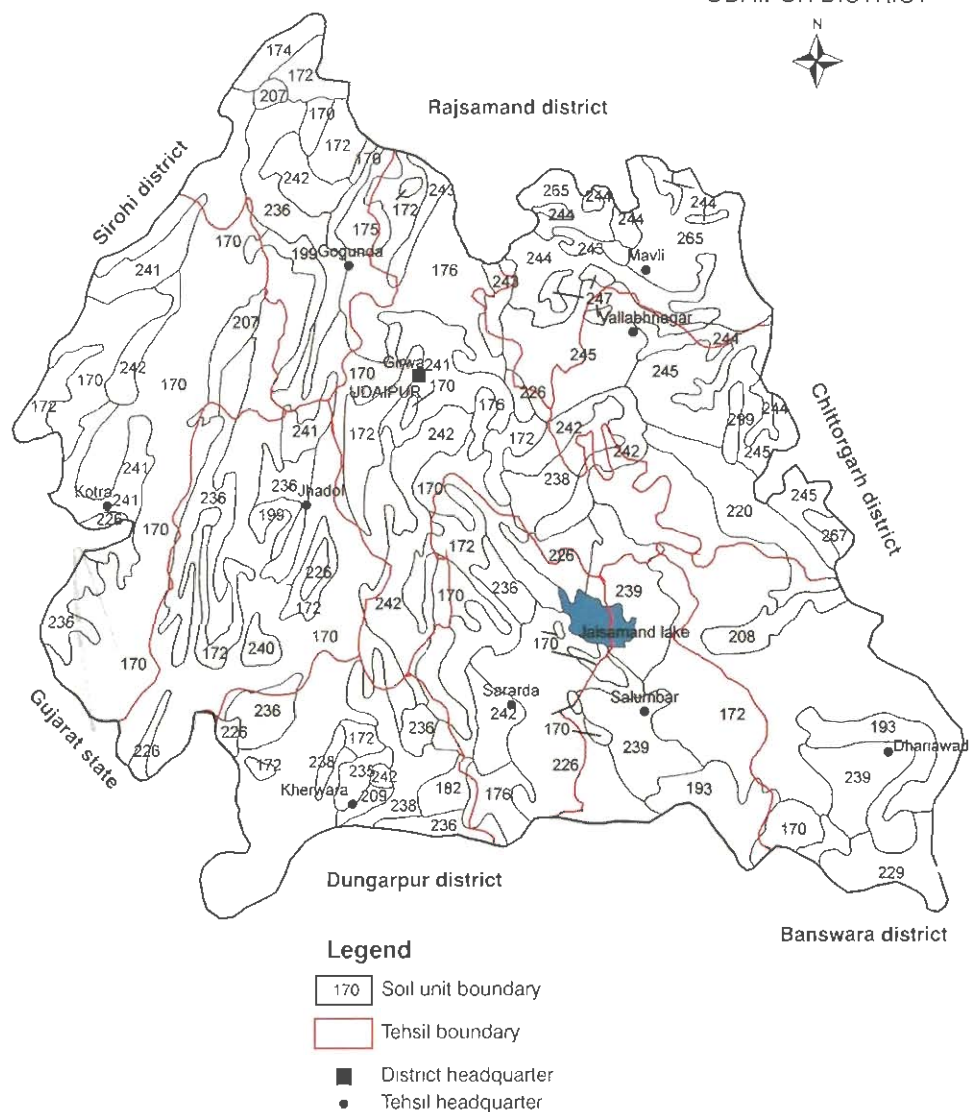
SOILS
UDAIPUR DISTRICT

Fig. 5

Major soils of the district have developed in situ on Aravalli metamorphic and alluvium. The hills and ridges of the district are mostly covered by rock outcrops associated with very shallow well drained, skeletal soils occurring on steep slopes and are severely eroded. Soils on foot slopes and pediments are shallow to moderately shallow, well drained, laamy in texture and moderate to severely eroded. In eastern and north eastern parts of the district, the soils are alluvium in nature and deep, well drained, fine textured occurring on gently sloping plains. Salinity and sodicity in patches have developed in the depression and basin like land forms.

2.2 Thematic Maps

Thematic maps characterize fertility parameters and soil suitability. They were generated in GIS environment. Dominant soils representing 60 per cent area of the mapping unit have been shown in background with colour. Sub dominant soils representing 40 per cent area of the mapping unit have been super imposed as hatching (pattern) over the colours of dominant soils. As such the thematic maps depict combination of dominant and sub dominant soils in an intergrated manner. It will help in better understanding of the distribution of the associated soils and help in suggesting management practices for efficient land use. Thematic maps for fertility parameters (pH, OC, available micronutrients) have been shown as average values for the map units.

2.2.1 Soil Depth

Soil depth suggest the volume of soil from which roots can acquire nutrient and water for their growth. In Udaipur district the very shallow to shallow soils constitute 19 percent area, moderately shallow soils to moderately deep 43.9 percent area and deep soils 8.9 percent area (Table 4 and Fig.6). The rock outcrops covers an area of 27.5 percent. In Aravalli region 21.5 percent of soils are very shallow to shallow and 41.7 percent soils are moderately shallow to moderately deep. In ER upland 32.7 percent soils are moderately shallow to moderately deep and 67.2 percent soils are deep. In Dhariawad, Gogunda, Jhadol, Kotra and Kherwara tehsil rock outcrops constitutes 30-45 % area. Shallow to very shallow soils constitute 30-35% area of Kotra and Girwa tehsil and 20-25% area in Gogunda, Jhadol and Kherwara tehsil. Moderately deep to deep soils constitute >80% area in Mavli and Vallabhnagar tehsil, 60-80% in Salumbar and 40-60% in Dhariawad, Gogunda, Sarada, Girwa and Kherwara tehsil and <40% in Kotra tehsil.

Western part of the district in Jhadol, Kotra and Gogunda tehsil is associated with shallow soils whereas rock outcrops in Salumbar, Dhariawad and Vallabhnagar tehsil are associated with moderately shallow soils. Dominant soils besides rock outcrops in Jhadol, Kotra and Gogunda tehsil are moderately shallow to deep and associated with moderately shallow and very shallow soils in northern part of Kotra and Gogunda tehsil. In Sarada, Salumbar, Girwa and Dhariawad tehsil, beside rock outcrops, both dominant and subdominant soils are moderately shallow with pockets of very shallow soils and rock outcrops. In eastern part of Gogunda and northern part of Girwa tehsil the dominant soils are very shallow associated with deep soils in valleys. South eastern part of Girwa are moderately shallow to deep associated with shallow soils. In Mavli tehsil which constitutes ER upland, dominant and subdominant soils are moderately shallow to deep. Similarly soils of southern part of Dhariawad tehsil are moderately shallow to moderately deep.

SOIL DEPTH UDAIPUR DISTRICT

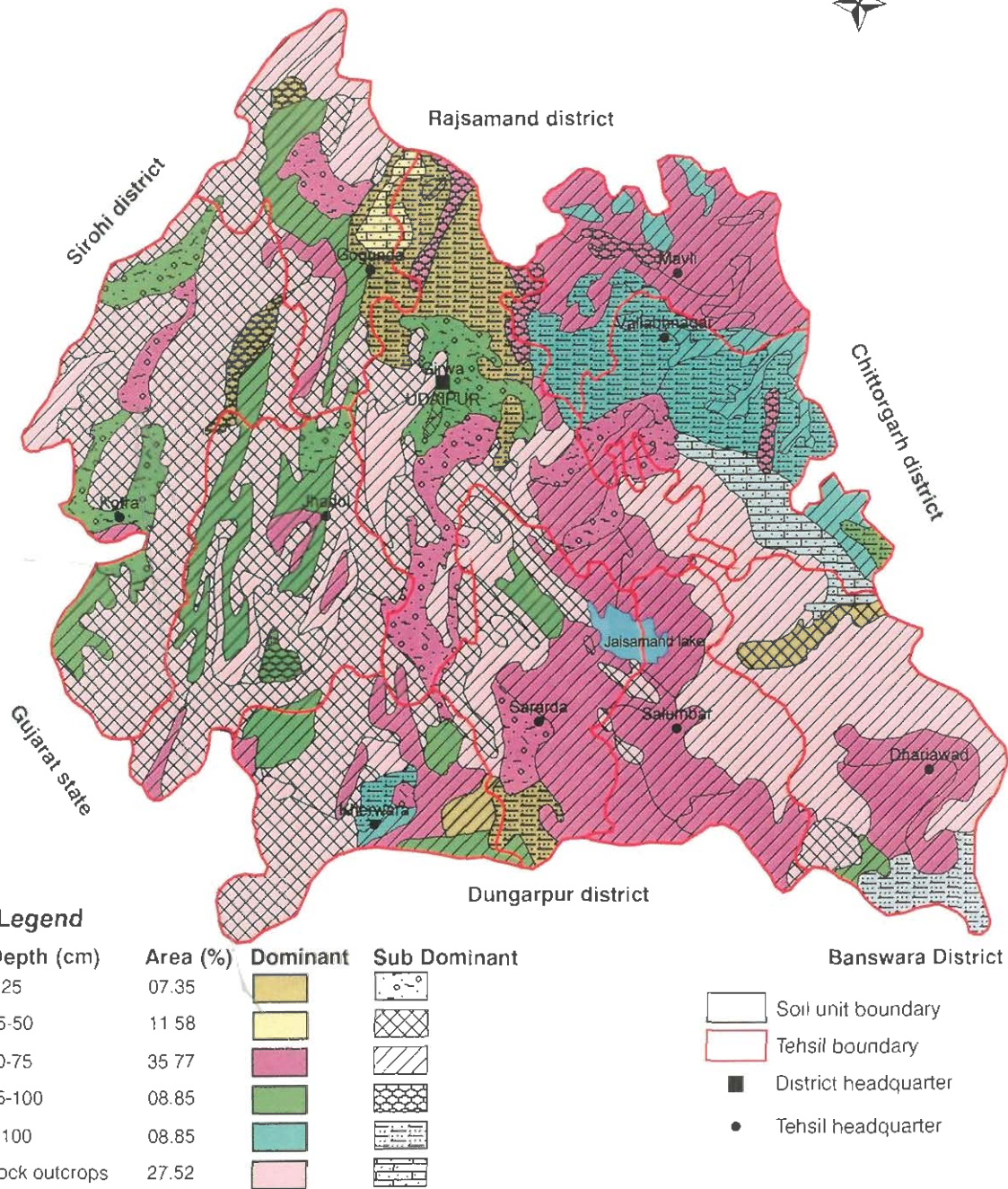


Fig. 6

Table 4. Soil depth wise area (ha) in different tehsils of Udaipur district

Tehsil	Very shallow	Shallow	Moderately shallow	Moderately deep	Deep	Rock outcrops
	<25 cm	25-50 cm	50-75 cm	75-100 cm	>100 cm	
Dhariawad	4221	4829	53827	8524	6249	43286
Gogunda	9169	13786	24329	11605	3184	28697
Jhadol	2612	31547	26487	25322	0	58129
Kherwara	4571	21112	32449	10538	6560	34978
Kotra	22455	64557	18641	34097	0	102485
Mavli	192	0	53249	1810	27659	0
Salumbar	0	2274	113794	0	0	32172
Sarada	17468	17443	119889	8111	6147	48921
Girwa	43776	13808	58824	15313	17327	39696
Vallabhnagar	3065	0	21424	2389	62247	14015
Total (%)	107598 (7.35)	169454 (11.58)	523293 (35.77)	117789 (8.05)	129499 (8.85)	402636 (27.52)

2.2.2 Particle size class (Texture)

Soil textural class affects soil characteristics directly or indirectly and gives an idea of soil water retention, availability of water to plant, soil genesis, infiltration, drainage and crop suitability class. Particle size class distribution of Udaipur district (Table 5 and Fig. 7) shows 45.4% fine loam to clay and 8.3% coarse loam to loam soils. Skeletal soils constitute 18.2% of the area besides 27.5 % rock outcrops. In Aravalli region 19.8% area is under skeletal soils and 36.4% area is of fine loam texture. In ER upland fine loam soil constitutes 34.2% and clay soil 56.0% of the region. Clay soils constitute 40% area in Vallabhnagar and 10-15% area in Mavli and Sarada tehsil. Fine loam soils constitute >80% in Mavli tehsil and 40-50% in Dhariawad, Salumbar and Sarada tehsil, 30-40% in Gogunda, Jhadol, Kherwara Girwa and Vallabhnagar tehsil and 20-30% in Kotra tehsil. Coarse loam to loam soils constitute 10-20% area in Dhariawad, Salumbar, Girwa and Vallabhnagar tehsil and <10% in remaining tehsils. Skeletal soils constitute 25-30% area in Gogunda, Jhadol, Kherwara, Girwa and Kotra tehsil.

Table 5. Particle size class (Texture) distribution in soils of Udaipur district (area in ha)

Tehsil	Textural class					
	Clay	Coarse Loamy	Fine Loamy	Loamy	Loamy Skeletal	Sandy
Dhariawad	0	12163	56438	2814	6236	0
Gogunda	0	3275	31299	3159	24340	0
Jhadol	1730	0	44849	1758	37631	0
Kherwara	741	3211	41704	0	27729	1844
Kotra	688	0	51589	13917	73556	0
Mavli	10899	3325	68493	0	192	0
Salumbar	8562	29286	75946	0	2274	0
Sarada	33775	7108	92984	0	35191	0
Girwa	4628	20283	66552	9634	47950	0
Vallabhnagar	41507	11493	32091	0	10277	969
Total (%)	102534 (7.01)	90148 (6.17)	561951 (38.43)	31284 (2.14)	265382 (18.15)	2814 (0.19)

Rock outcrops in western part of the district in Kotra, Jhadol and Gogunda are mainly associated with skeletal soils. In valley portions both dominant and subdominant soils are loam to fine loam. Rock outcrops in eastern part of district in Salumbar and Dhariawad tehsil are associated with fine loam soils. Soils of Mavli, Vallabhnagar, Sarada and Dhariawad tehsil are fine loam to clay. Soils of part of southern portion of Vallabhnagar are coarse loam associated with rock outcrops. Rock outcrops are predominantly associated with skeletal soils in western part of Udaipur whereas in eastern part rock outcrops are associated with loamy soils. Valley in Aravalli region are mainly fine loam to clay. Soils of ER upland mainly in Mavli tehsil are clay associated with fine loamy soils.

2.2.3 Slope

Thematic map of slope (Fig. 8) indicates variability in slopes (Table 6) from very gentle (14.0%), gentle (32.0%) to steep (12.4%). In Aravalli physiographic region 40.8% area is having very gentle to gentle slope and 18.3% moderately steep to steep slope. In ER upland soils are mainly of very gentle to gentle slope and marked with absence of steep slopes. In Mavli and Vallabhnagar tehsil over 80% soils are having gentle to very gentle slope as compared to 40-50% area in other tehsils. Steep to very steep slopy land constitute 25-30% area in Gogunda, Jhadol, Kherwara, Kotra and Girwa tehsil.

Rock outcrops in Aravalli landscape has slope varying from gentle to steeply sloping for subdominant soils predominantly in Gogunda, Kotra, Jhadol and Girwa tehsil whereas associated soils with rock outcrops in Salumbar and Vallabhnagar tehsil are mainly gently sloping. Dominant families in Aravalli region besides rock outcrops are gently sloping with gentle to moderate slope in subdominant families.

In ER upland in Mavli tehsil the soils are very gentle to gently slope both in dominant and subdominant phase. With respect to slope steeply sloping soil occurs in part of Gogunda, Kherwara and Girwa tehsil as dominant families with subdominant families of very gentle slopes. Part of Vallabh Nagar tehsil have gently sloping soil in dominant families along with steeply sloping soil in subdominant family. Combining dominant and subdominant family indicates occurrence of pockets of cultivated area having gentle slope in between rock outcrops and steeply sloping land.

Table 6. Slope distribution in soils of Udaipur district (Area in ha)

Tehsil	Slope class					
	Very gentle	Gentle	Moderate	Moderately steep	Steep	Rock outcrops
	1-3%	3-8%	8-15%	15-30%	30-50%	
Dhariawad	5683	57942	12013	0	2014	43286
Gogunda	10304	27096	3673	5263	15738	28697
Jhadol	10713	34136	5282	4290	31547	58129
Kherwara	29342	19464	741	836	24847	34978
Kotra	6615	44974	20014	3590	64557	102484
Mavli	58810	7536	16372	0	192	0
Salumbar	0	85518	28276	0	2274	32172
Sarada	12280	87130	34736	7828	27083	48921
Girwa	33233	54784	13080	35452	12497	39696
Vallabh Nagar	37186	48875	0	3065	0	14015
Total (%)	204168 (13.96)	467459 (31.97)	134191 (9.18)	60327 (4.13)	180754 (12.36)	402384 (27.52)

2.2.4 Surface stoniness

Surface stoniness affects germination and tillage operations. Distribution of surface stoniness in Udaipur district (Table 7 and Fig. 9) shows 10.6% and 19.0% soils with moderate and strong stoniness in Aravalli region and absent in Eastern Rajasthan Upland. Overall in Udaipur district 27.3% area is affected by moderate and strong stoniness mainly in western part of the district. Soils in Gogunda, Jhadol, Kherwara, Kotra and Sarada tehsil are having 15-30% strong stoniness and 10-25% moderate stoniness.

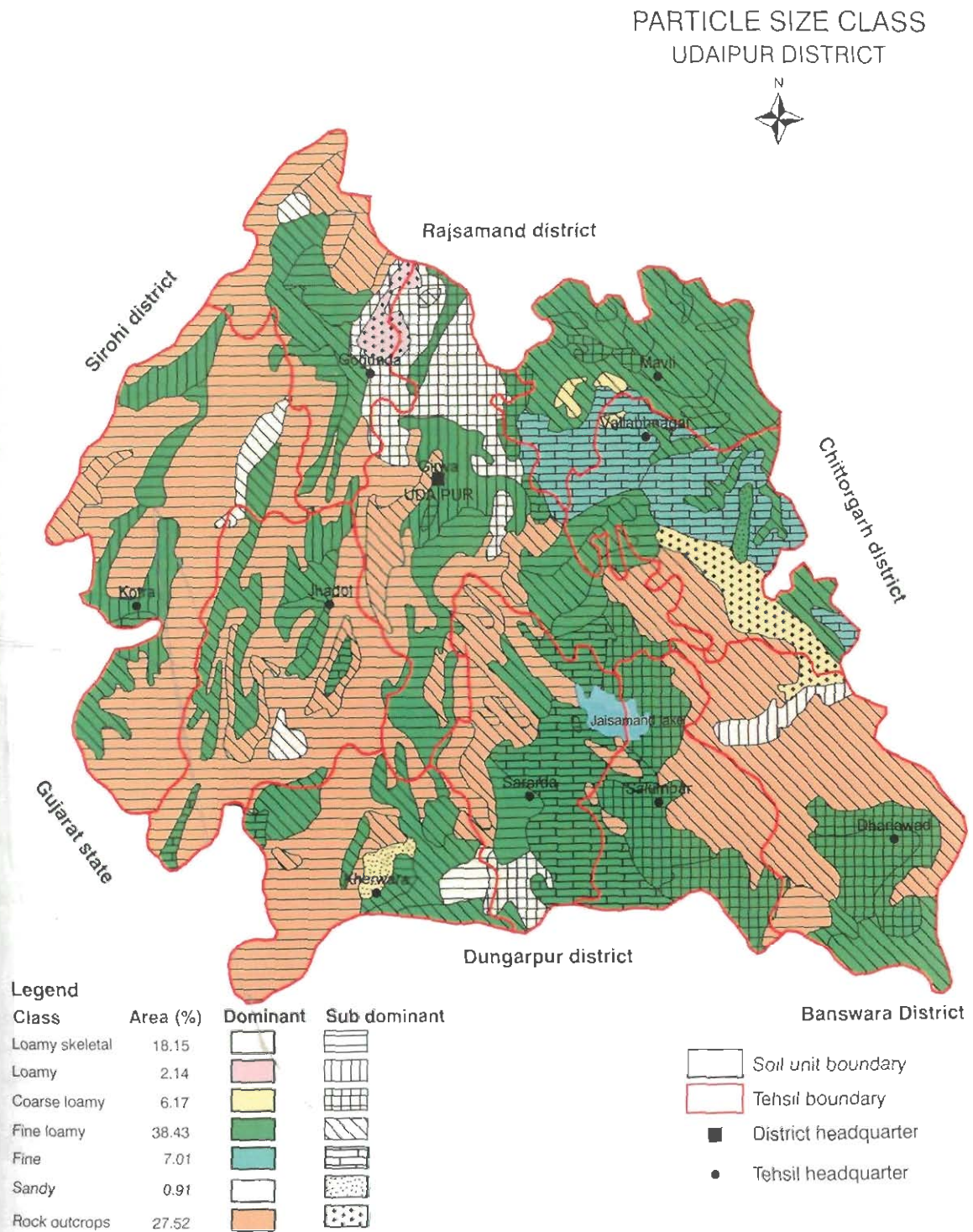
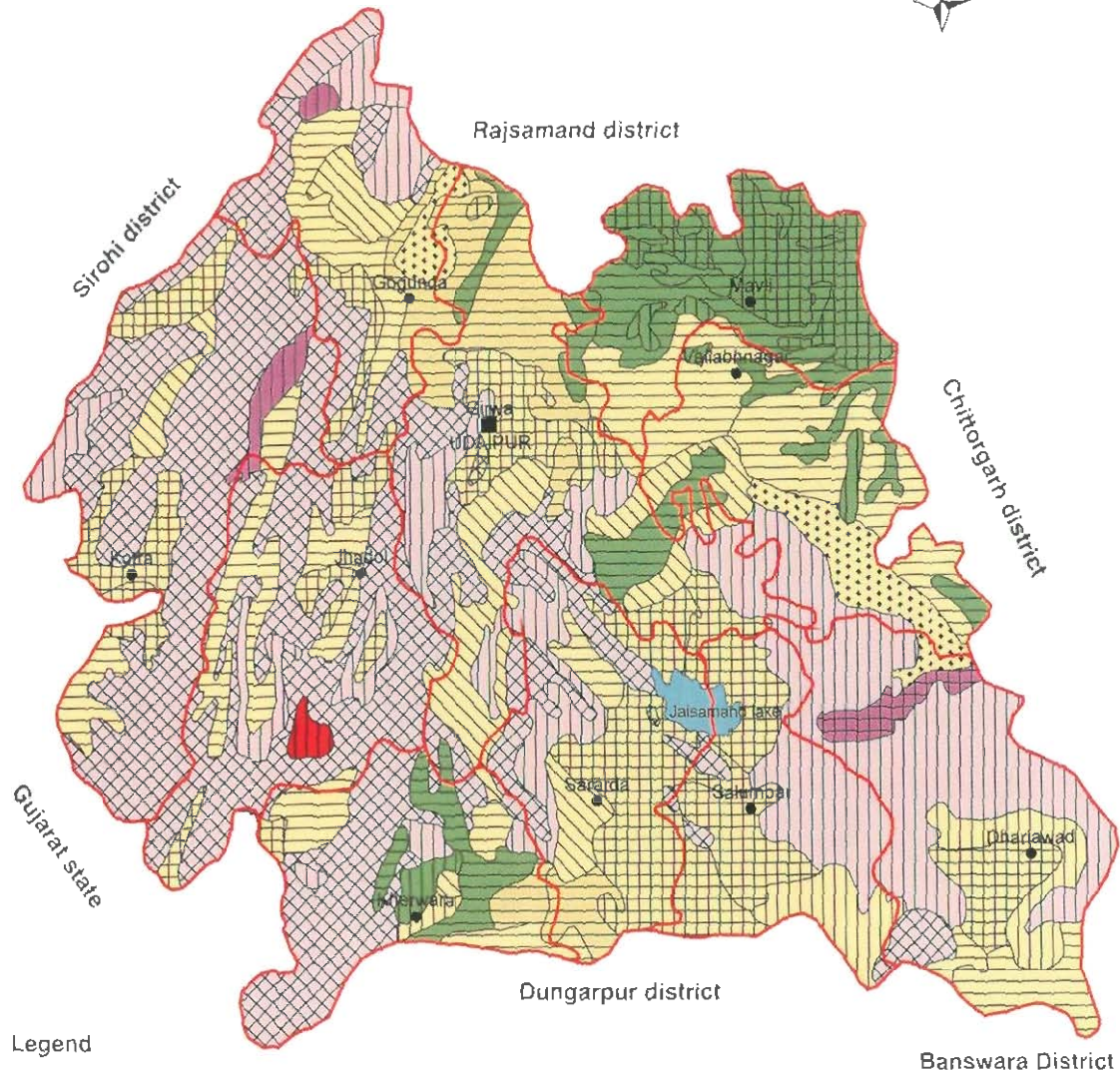


Fig. 7

SLOPE
UDAIPUR DISTRICT



Legend

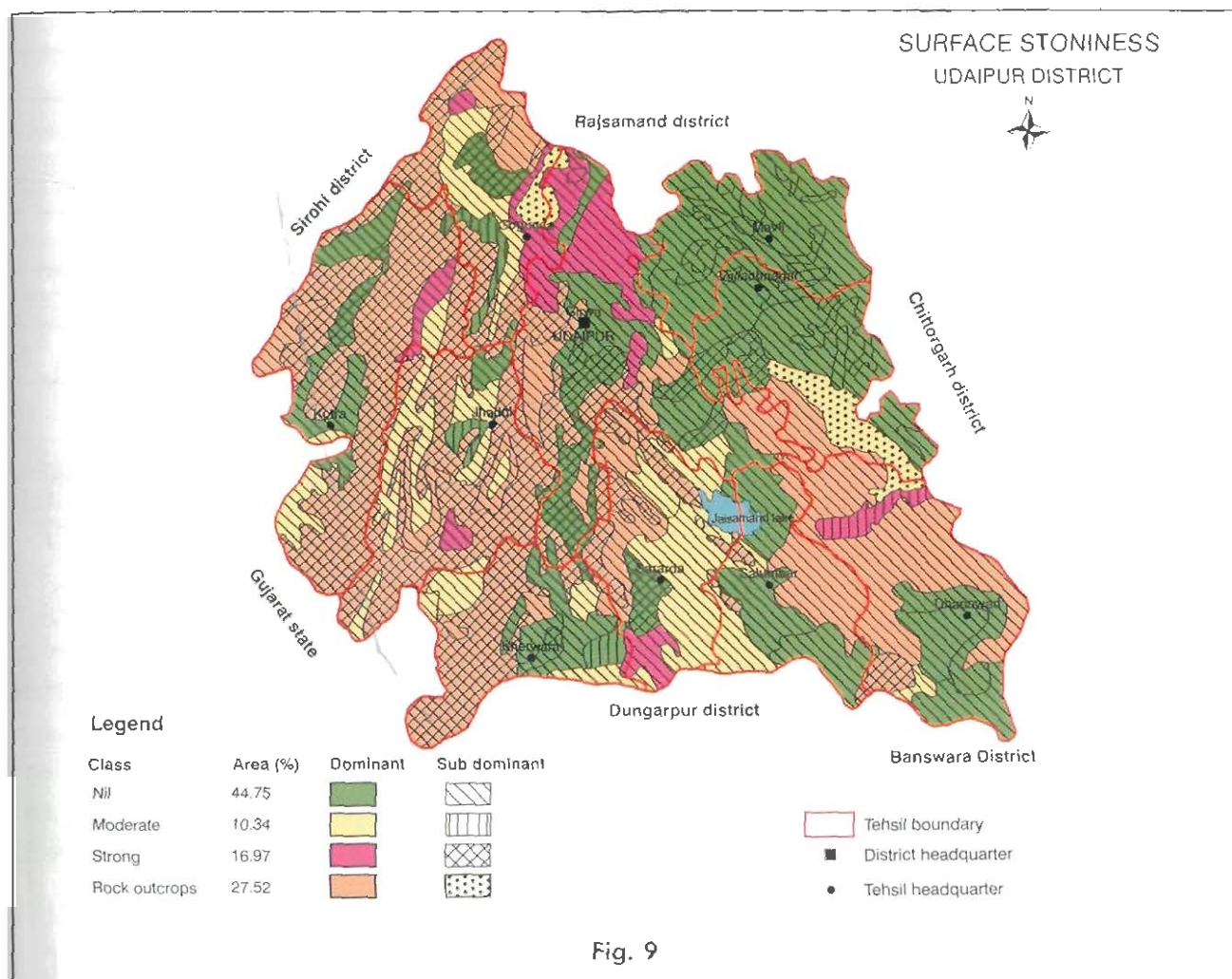
Class	Area (%)	Dominant	Sub dominant
1-3	13.96		
3-8	31.97		
8-15	9.18		
15-30	4.13		
30-50	12.36		
Rock outcrops	27.52		

- Tehsil boundary
- District headquarter
- Tehsil headquarter

Fig. 8

Table 7. Stoniness distribution in soils of Udaipur district (Area in ha)

Tehsil	Stoniness class	
	Moderate (15-40%)	Strong (>40%)
Dhariawad	5641	6237
Gogunda	15490	22014
Jhadol	20079	36219
Kherwara	11651	22615
Kotra	11417	73095
Mavli	121	193
Salumbar	12844	2275
Sarada	58775	34492
Girwa	4951	47951
Vallabhnagar	10206	3066
Total (%)	151174 (10.34)	248154 (16.97)



2.2.5 Water erosion

The water erosion in Udaipur district (Table 8 and Fig. 10) shows 32.6% and 39.0% area is affected by moderate and severe erosion, respectively. In Aravalli region 27.3 and 35.6% area is affected by moderate and severe erosion whereas in ER upland 53.2% area is affected by moderate erosion. Severely eroded area constitutes 52% in Dhariawad and Mavli tehsil and 30-40% in Gogunda, Jhadol, Kherwara, Kotra, Salumbar, Sarada and Vallabhnagar tehsil. 40-50% area is moderately eroded in Mavli, Salumbar and Vallabhnagar tehsil. Rock outcrops in the district is associated with severe erosion. Valley portions in Kotra, Jhadol and Gogunda tehsil are moderately eroded. Dominant soils of Vallabhnagar and Sarada tehsil are moderately eroded with severely eroded subdominant soils. Soils of Mavli tehsil which represent ER upland are severely eroded for dominant families and moderately eroded for subdominant families. Soils of Kherwara tehsil excluding rock outcrops are moderately eroded. A portion of Kherwara tehsil has very severe erosion in subdominant families.

Table 8. Water erosion distribution in soils of Udaipur district (Area in ha)

Tehsil	Erosion class			Tehsil	Erosion class		
	Moderate	Severe	Very severe		Moderate	Severe	Very severe
Dhariawad	14701	62952	0	Mavli	40169	42743	0
Gogunda	32567	29509	0	Salumbar	62128	53941	0
Jhadol	37644	48326	0	Sarada	84922	83859	280
Kherwara	40202	32984	2046	Girwa	71841	77208	0
Kotra	47824	91928	0	Vallabhnagar	44228	44899	0
Total (%)	476226 (32.57)	568349 (38.87)	2326 (0.16)		476226 (32.57)	568349 (38.87)	2326 (0.16)

2.2.6 Salinity

The salinity in soils of Udaipur district (Table 9 and Fig. 11) shows 3.0% area with pockets of moderate salinity extending upto 33% area of the mapping units whereas 1.1% area of the district has pockets of severe salinity extending upto 50% area of the units. In Aravalli region only 1.1% area is affected by moderate salinity whereas in ER upland 35.9 and 4.4% area is affected by moderate and severe salinity. Moderate to severe salinity problems in Udaipur district occurs in Mavli (39.7%) and Vallabhanagar (29.2%) tehsil. Pockets of slight salinity (37.0%) are also occurring in Sarada tehsil. Pockets of severe salinity occurs in subdominant families in Mavli (17.6%) tehsil.

SOIL EROSION UDAIPUR DISTRICT

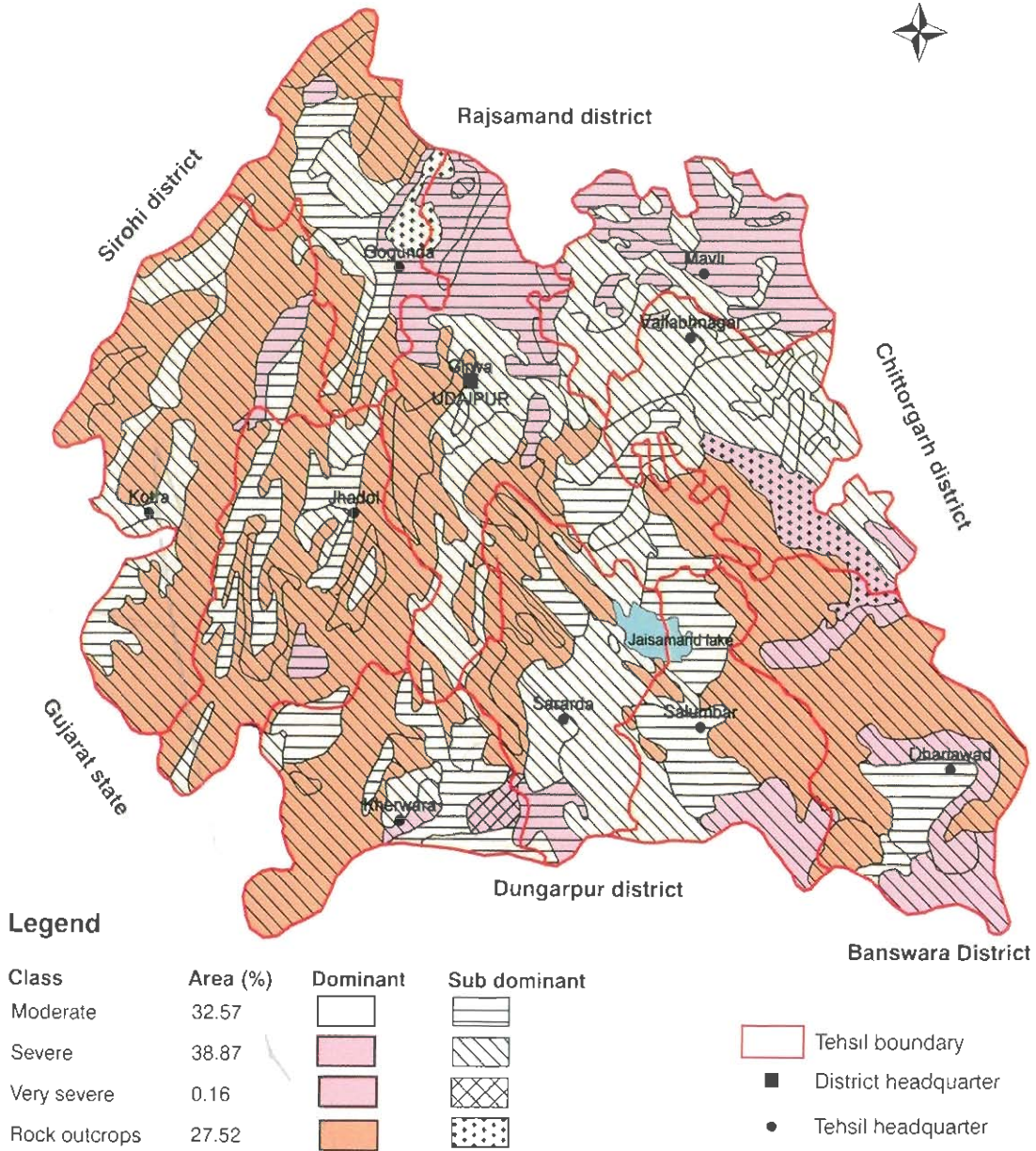
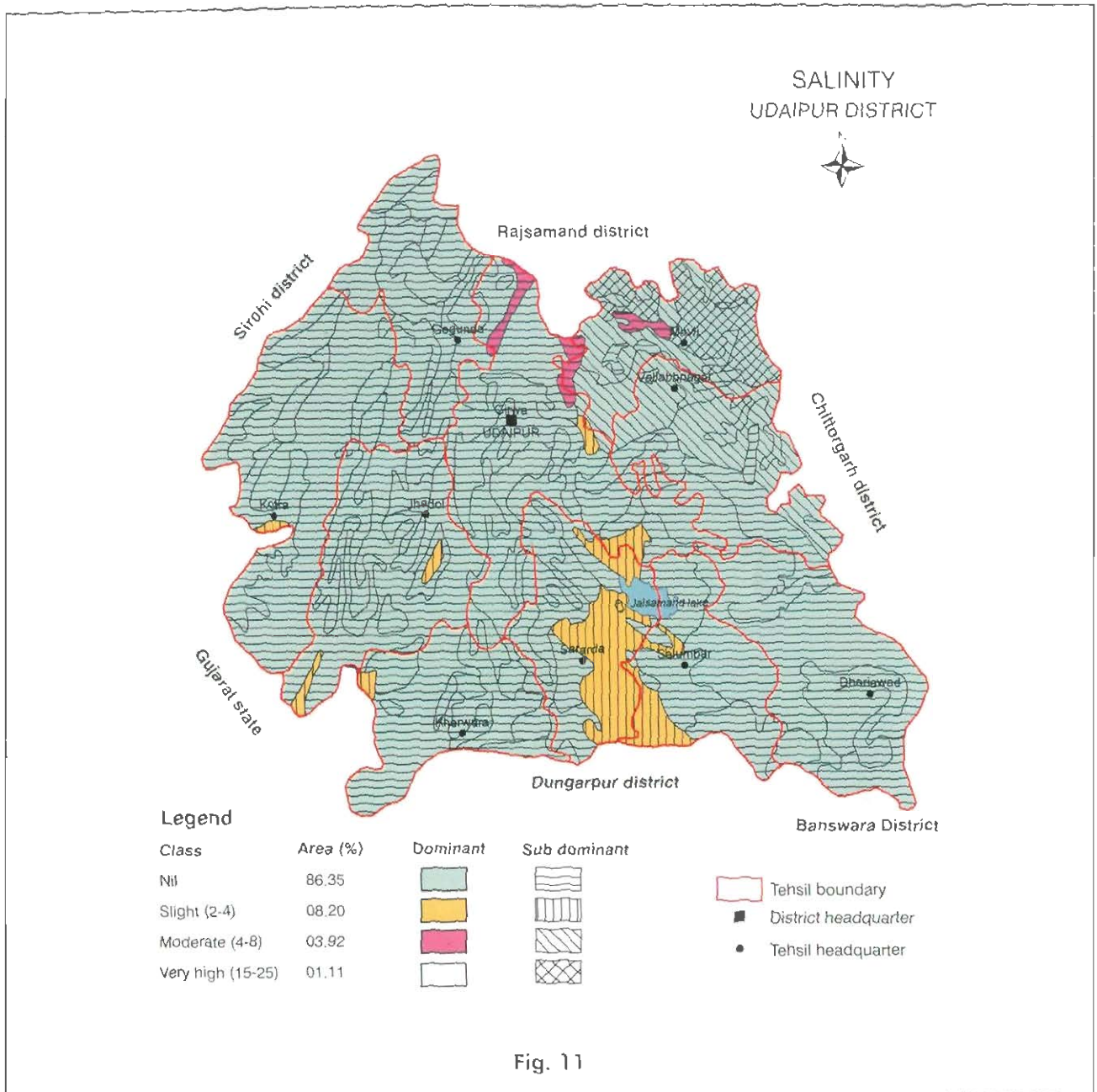


Fig. 10



2.2.7 Sodicty

Sodicty distribution in soils of Udaipur district (Table 9 and Fig. 12) shows 8.7% area in pockets to the extent of 33% is affected by moderate sodicty. Sodicty problem is only of moderate level (ESP 5-15) predominantly in areas receiving irrigation from major and minor irrigation projects in Saroda and Salumbar tehsil and pockets in Jhadol, Kotra, Girwa and Mavli tehsil. In Aravalli region 5.8% area and in ER upland 9.4% area are moderately affected by sodicty in pockets. Sodicty problem is also associated with moderate to severe salinity problems.

Table 9. Salinity and sodicity distribution in soils of Udaipur district (Area in ha)

Tehsil	Salinity class			Sodicity class	
	Slight 2-4 dSm ⁻¹	Moderate 4-8 dSm ⁻¹	Very high 15-25 dSm ⁻¹	Slight ESP 2-5	Moderate ESP 5-15
Dhariawad	0	0	0	0	0
Gogunda	0	136	0	0	136
Jhadol	4327	0	0	0	4327
Kherwara	1855	0	0	0	1855
Kotra	1721	0	0	0	1721
Mavli	201	16645	16292	30221	2917
Salumbar	21406	0	0	0	21406
Sarada	84439	0	0	0	84439
Girwa	6067	5123	0	881	10309
Vallabhnagar	0	22195	0	22195	0
Total (%)	120016 (8.20)	44099 (3.92)	16292 (1.11)	53297 (3.65)	127110 (8.69)

2.2.8 Soil distribution and classification

Soils of Udaipur district have been classified according to USDA soil taxonomy (Table 10 and Fig.13). Inceptisols (Haplustepts) and Entisols (Ustorthents) are dominantly observed covering 47.0 and 18.4% area, respectively. Vertisols (Haplusterts) and Alfisols (Haplustalfs) occupy minor area and constitute 2.7 and 3.7% area of the district. Rock outcrops which constitutes 27.5% area of the district has Lithic Ustorthents as subdominant family in Kotra, Jhadol and Gogunda tehsil and Typic Haplustepts in Salumbar and Dhariawad tehsil. Valley soils in Kotra, Jhadol and Gogunda tehsil are mainly Typic Haplustepts associated with Lithic Ustorthents and Typic Haplustepts. In Sarada, Kherwara, Salumbar and Dhariawad tehsil soils are mainly Typic Haplustepts. Soils in Vallabhnagar and part of Mavli tehsil are Vertic Haplustepts associated with Typic Haplusterts. ER upland region predominantly in Mavli tehsil comprises of Typic Ustorthent and Typic Haplusterts associated with Typic Haplustepts. Part of Girwa, Kherwara, Dhariawad and Kotra tehsil have Lithic Ustorthents associated with Typic Haplustepts.

Table 10. Taxonomic distribution of soils of Udaipur district

Order	Great group	Area (ha)	Percent
Inceptisol	Haplustepts	694963	47.0
Vertisol	Haplusterts	39440	2.7
Entisol	Ustorthents	269220	18.4
	Psamments	2800	0.2
Alfisol	Haplustalfs	54440	3.7
Rock outcrops		402637	27.5

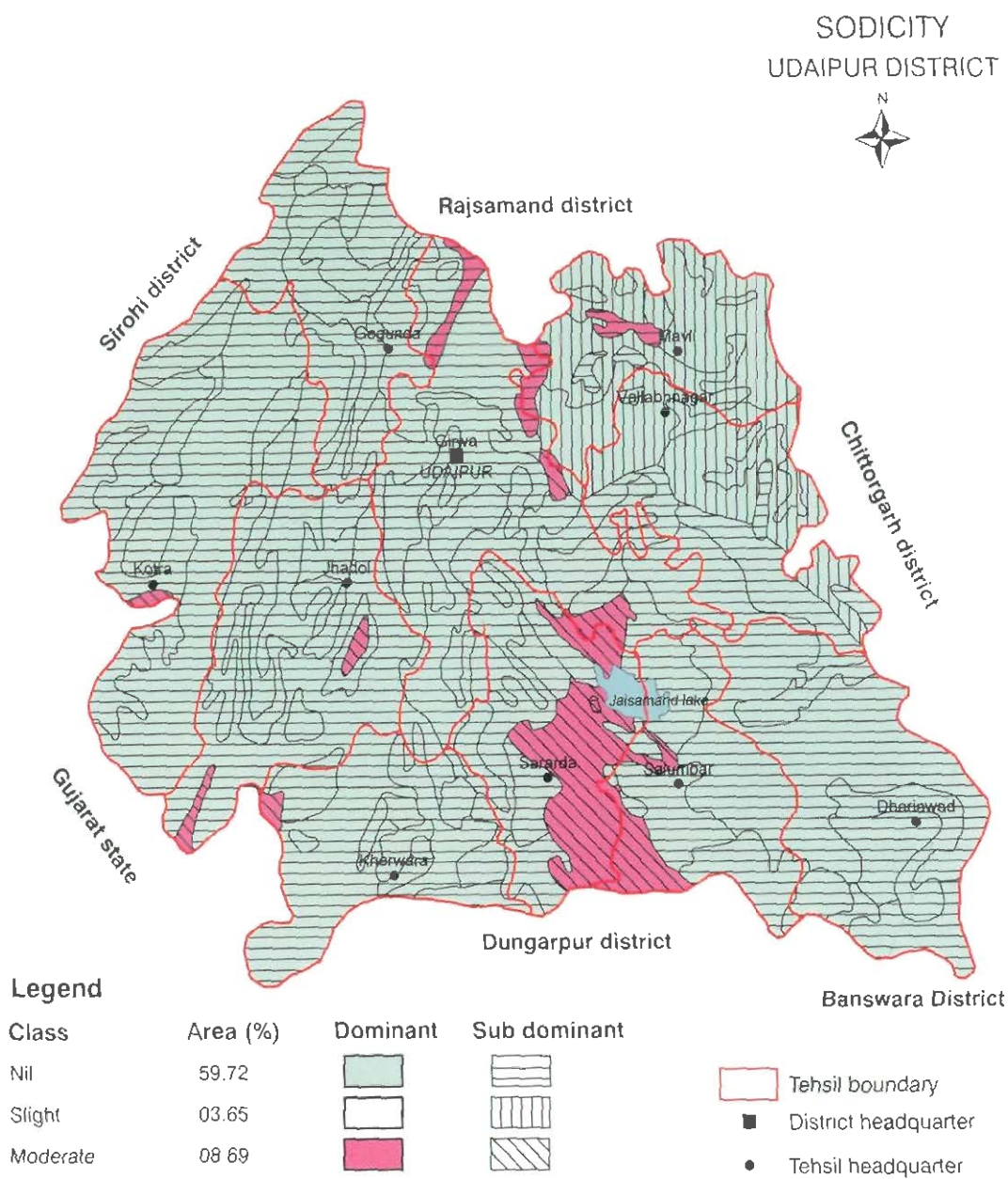


Fig. 12

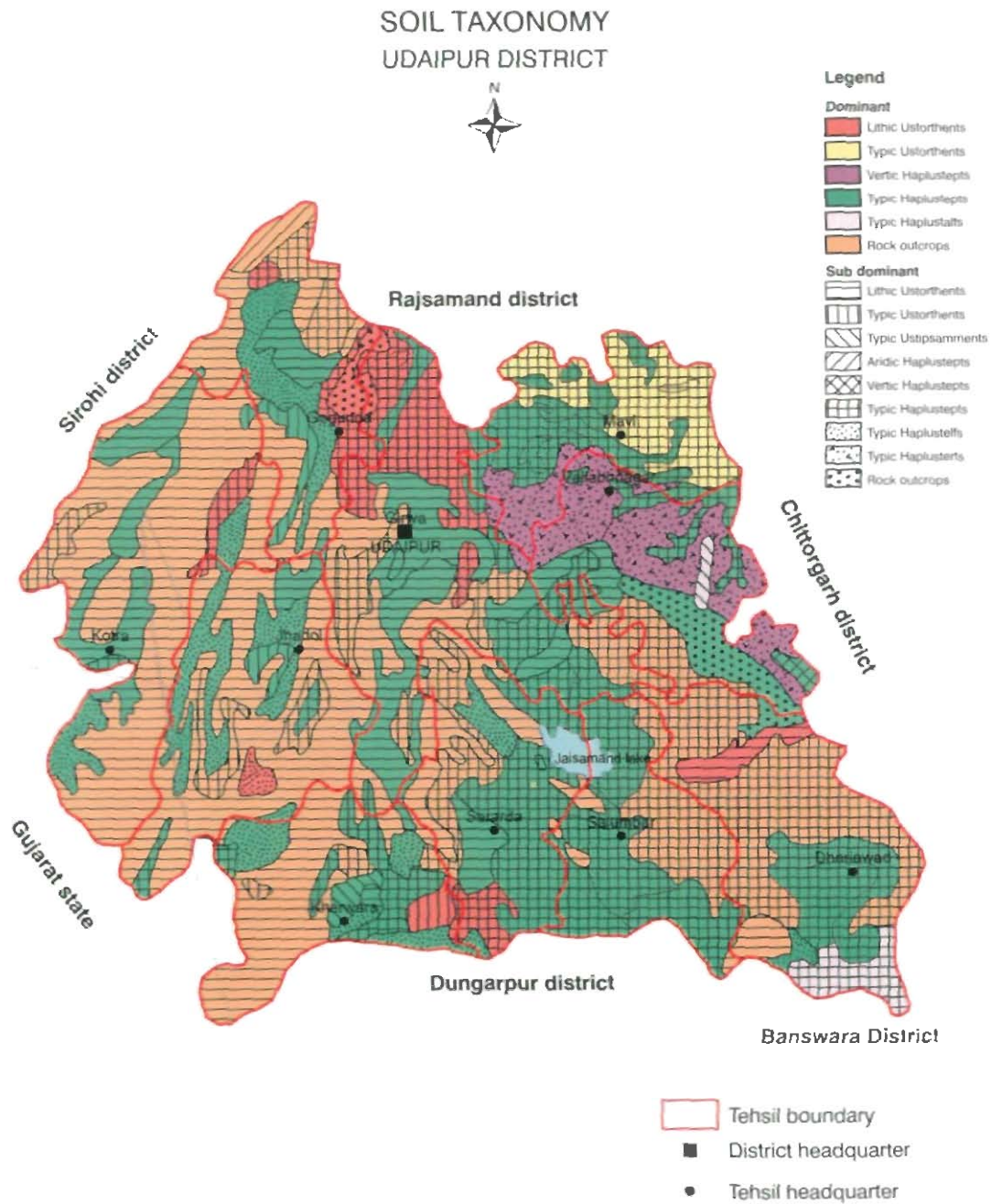
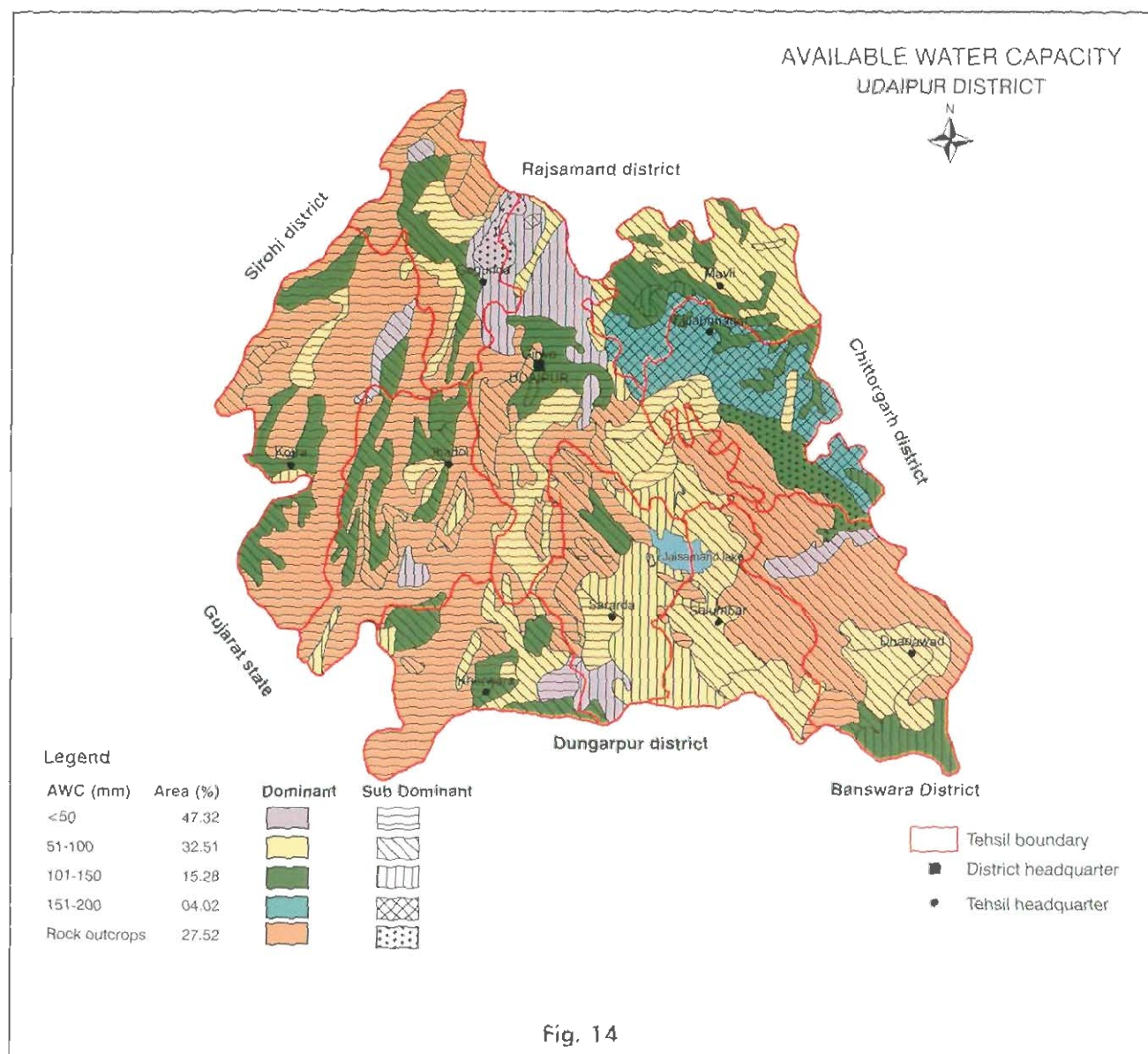


Fig. 13

2.2.9 Available Water Capacity (AWC)

AWC varies from <50 to 200 mm in Udaipur district (Table 11 and Fig. 14). Besides rock outcrops 19.8% area has AWC <50 mm, 32.5 and 15.3% area has AWC 50-100 and 100-150 mm respectively whereas 4.0% area of district has AWC between 150-200 mm. This variability in AWC influences the length of growing period in particular AEU. In Aravalli physiographic region 14.0% area has AWC between 100 to 150 mm, 30.6% has AWC between 50-100 mm. Rock outcrops and shallow skeletal soils covering 55% area of Aravalli region has AWC <50 mm. ER upland region has AWC between 150-200 mm in 65% area and between 50 to 100 mm in 31.8% area. In Kotra tehsil 78.4% area has AWC <50 mm and remaining area has AWC between 50-150 mm. In Gogunda, Jhadol, Kherwara,



Girwa and Vallabhnagar tehsil area having AWC <50 mm is between 40 to 58%. AWC is generally between 100-150 mm in 15-20% area in most of the tehsils whereas area with AWC 150-200 mm is only in Mavli (12.3%) and Vallabhnagar (44.3%) tehsil.

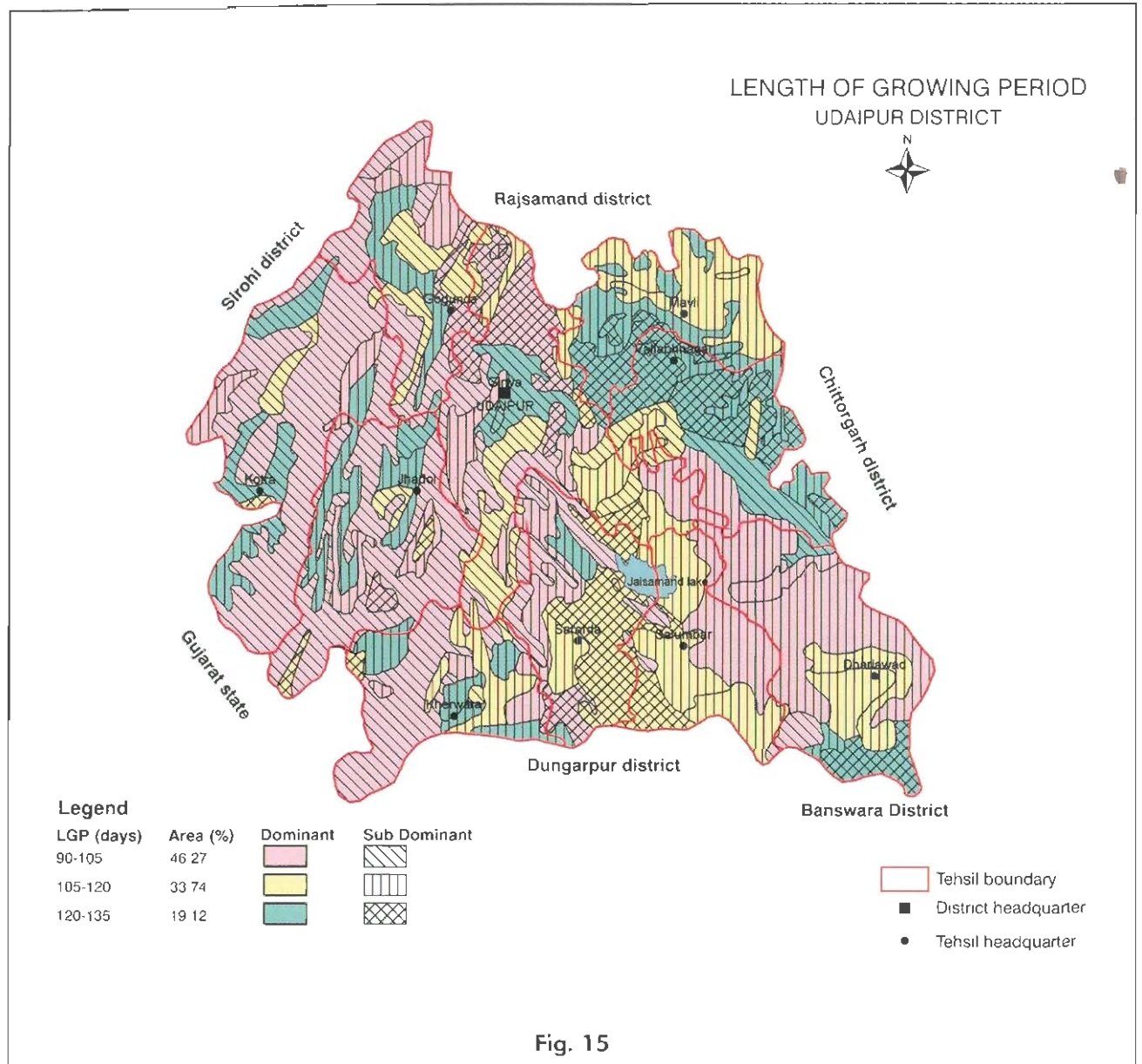
Associated soils with rock outcrops in eastern part of the district has AWC predominantly 50-100 mm whereas associated soils with rock outcrops in western part of the district has AWC <50 mm. Soils of Sarada Salumbar, Girwa and Mavli tehsils has AWC between 50-100 mm except pockets in Sarada tehsils with AWC of 100-150 mm. Valley soils in between rock outcrops in Jhadol, Kotra and Gogunda tehsil have AWC between 100-150 mm in dominant soils and 50-100 mm in associated soils. Soils of Vallabhnagar and part of Mavli tehsil has AWC between 150-200 mm.

2.2.10 Length of Growing Period (LGP)

LGP takes into consideration period of precipitation exceeding 0.5 PET plus period of utilization of stored moisture after cessation of monsoon. Variability in AWC influences the LGP in particular AEU. LGP in Udaipur district (Fig. 15 and Table 11) varies between 90-135 days. LGP is generally higher in ER Upland region between 105 - 135 days in 99.4% area and 90-120 days in 85.2% area in Aravalli region. Soils of part of Sarada (40.9%), Salumbar (65.5%), Girwa (32.1%), Dhariawad (46.8%) and Mavli tehsil (66.3%) have 105-120 days LGP. Soils of Vallabhnagar (61.7%) and part of Mavli (33.5%) tehsil have LGP of 120-135 days for dominant soils and between 90-105 days for subdominant soils. Soils of southern part of Dhariawad tehsil (12.2%) has LGP of 120-135 days. Valley soils in between rock outcrops in Jhadol, Kotra and Gogunda tehsil have 120-135 days LGP in dominant soils and 105-120 days in Subdominant soils. Associated soils with rock outcrops in Kotra, Jhadol and Gogunda tehsil has LGP between 90-105 day whereas associated soils in Salumbar, Dhariawad and Sarada tehsil has LGP of 105-120 days.

Table 11. AWC and LGP (days) distribution of soils of Udaipur district (Area in ha)

Tehsil	Available water capacity (mm/m)				LGP (days)		
	0-50	50-100	100-150	> 150	90-105	105-120	120-135
Dhariawad	49523	56642	14775	0	49523	56642	14774
Gogunda	56197	20551	14025	0	53372	23375	14024
Jhadol	97520	23598	22982	0	97519	23597	22982
Kherwara	64553	29662	15996	0	60662	33552	159961
Kotra	189959	20790	31489	0	189958	20789	31488
Mavli	193	54979	16921	10819	192	54979	27740
Salumbar	34447	105232	8562	0	34447	105232	8562
Sarada	84113	85834	48034	0	76799	93148	48034
Girwa	97281	59225	30038	2201	95970	60535	32239
Vallabhnagar	18050	18790	20576	45727	18050	21424	63667
Total (%)	691838 (47.32)	475303 (32.51)	223398 (15.28)	58747 (4.02)	676498 (46.27)	493277 (33.74)	279510 (19.12)



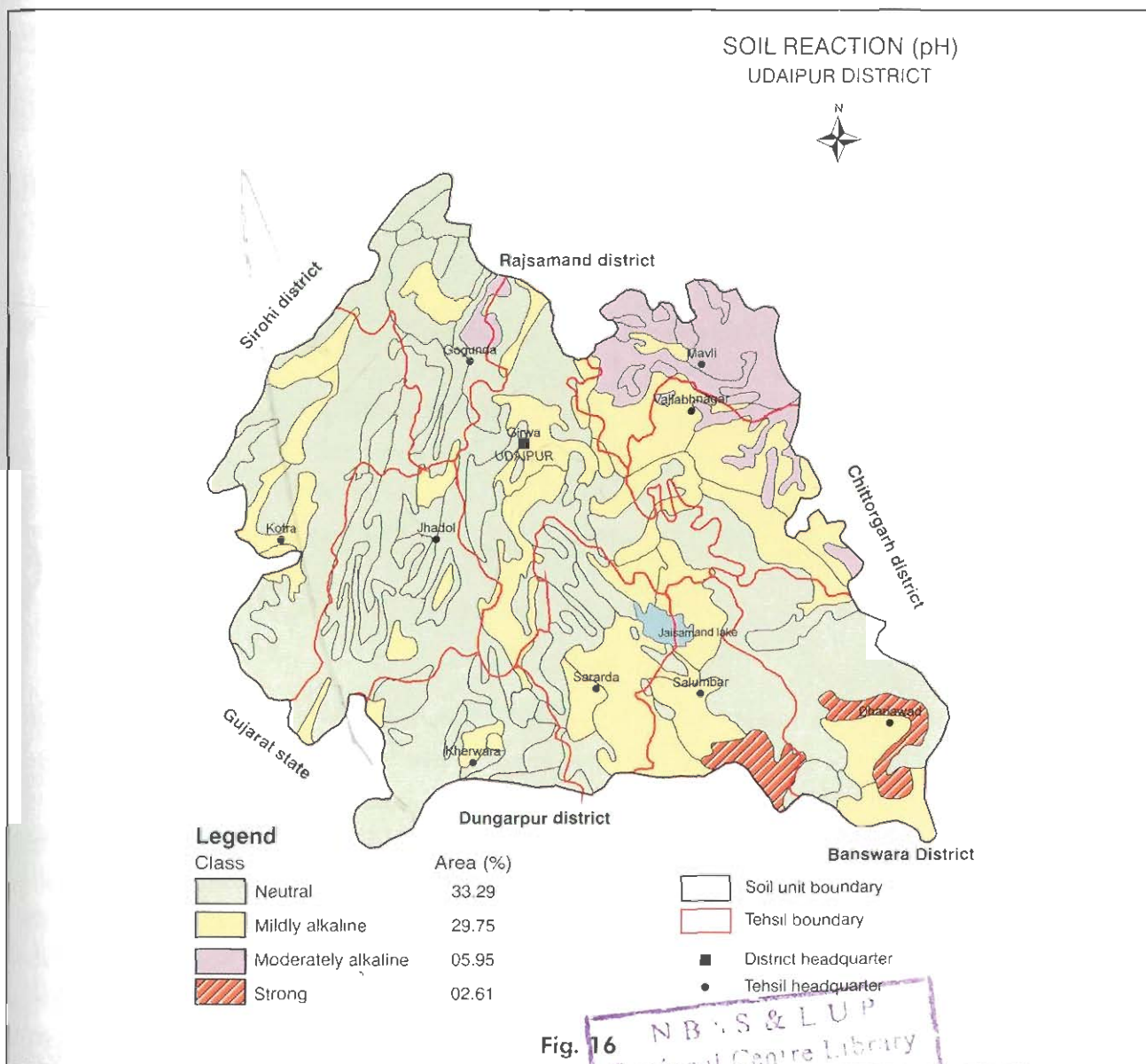
2.3. Fertility Status

Soil fertility refers to the status of soils with respect to availability of nutrients necessary for plant growth. Of all the nutrients N, P, K are most likely to be in short supply on cultivated lands. However increasing evidence of micronutrient deficiency due to intensive cropping, use of high analysis fertilizers and other management practices has become a constraint in sustainable agriculture. pH and organic carbon in given environment govern the availability of nutrients. Fertility status of Udaipur district for available N, P and K has been evaluated on the basis of surface soil samples analysed under soil testing programme by state department of Agriculture. Soil pH, organic carbon and available micronutrients

has been evaluated on the basis of surface grid samples. Thematic maps has been generated in GIS environment. Fertility status has been interpreted at tehsil level.

2.3.1 Soil reaction (pH)

pH of the soils of Udaipur district (Table 12 and Fig. 16) varies from 6.6 to 9.0. Majority of soils are neutral (33.3%) and mildly alkaline (29.7%). Moderately alkaline soils (5.95%) occurs mainly in Mavli (80.9%), Vallabhnagar (16.2%) and Gogunda tehsil (2.1%). These soils are in foot hills and calcareous in nature. Strangly alkaline soils (2.6%) occurs mainly in Salumbar (15.8%) and Dhoriawad (11.8%) tehsil in pediments.



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Table 12. Soil Reaction (pH) distribution in soils of Udaipur district

Tehsil	pH class			
	Neutral (6.6-7.3)	Mildly Alkaline (7.4 – 7.8)	Moderately Alkaline (7.9-8.4)	Strongly Alkaline (8.5-9.0)
Dhariawad	37501	25860	0	14293
Gogunda	51514	8679	1883	0
Jhadol	69703	16268	0	0
Kherwara	66675	8557	0	0
Kotra	94260	45492	0	0
Mavli	321	15547	67044	0
Salumbar	21448	70691	0	23930
Sarada	62647	106413	0	0
Girwa	73851	73886	1311	0
Vallabhnagar	8833	63597	16697	0
Total (%)	486752 (33.29)	434989 (29.75)	86935 (5.95)	38223 (2.61)

2.3.2 Organic carbon

Organic carbon in soils of Udaipur district (Table 13 and Fig. 17) ranges between 0.26 to 1.04%. It is low in 34.3%, medium in 20.1% and high in 17.2% soils. Organic carbon is generally high in associated soils with rock outcrops in Kotra (30.0%), Jhadol (26.7%) and Gogunda (22.7%) tehsil. Organic carbon is also high in soils of southern part of Sarada tehsil. Organic carbon is generally medium in associated soils with rock out crops in Salumbar (45.2%) and Dhariawad (33.8%) tehsil, Kherwara tehsil (33.4%) and southern part of Girwa tehsil. It is low in soils of Mavli (99.6%) and Vallabhnagar tehsil and southern portion of Salumbar (30.6%) and Dhariawad tehsil (22.9%).

2.3.3 Available NPK

Soil testing for available nutrient status is regular activity for state department of Agriculture. Based on analysis of surface samples fertility status of soils have been categorized as low, medium and high with respect to available nitrogen, phosphorus and potassium. Soil nutrient index was calculated. Nutrient index value of less than 1.67 and more than 2.33 indicate low and high fertility status. Nutrient index value between 1.67 to 2.33 indicate medium fertility status. Nutrient index for available N, P and K for different tehsils of Udaipur district (Table 13) show low available nitrogen in 80-85% soils and medium in 15-20% soils. Soils of Girwa and Jhadol tehsil has relatively higher available nitrogen whereas soils of Vallabhnagar, Kherwara, Kotra and Sarada tehsil have relatively low available nitrogen. Available phosphorus is generally medium in the district. Available

phosphorus in soils of Salumbar tehsil is relatively high and low in soils of Dhariawad tehsil. Available potassium is generally high in the district. Overall fertility status for the district is low for nitrogen, medium for phosphorus and high for potassium.

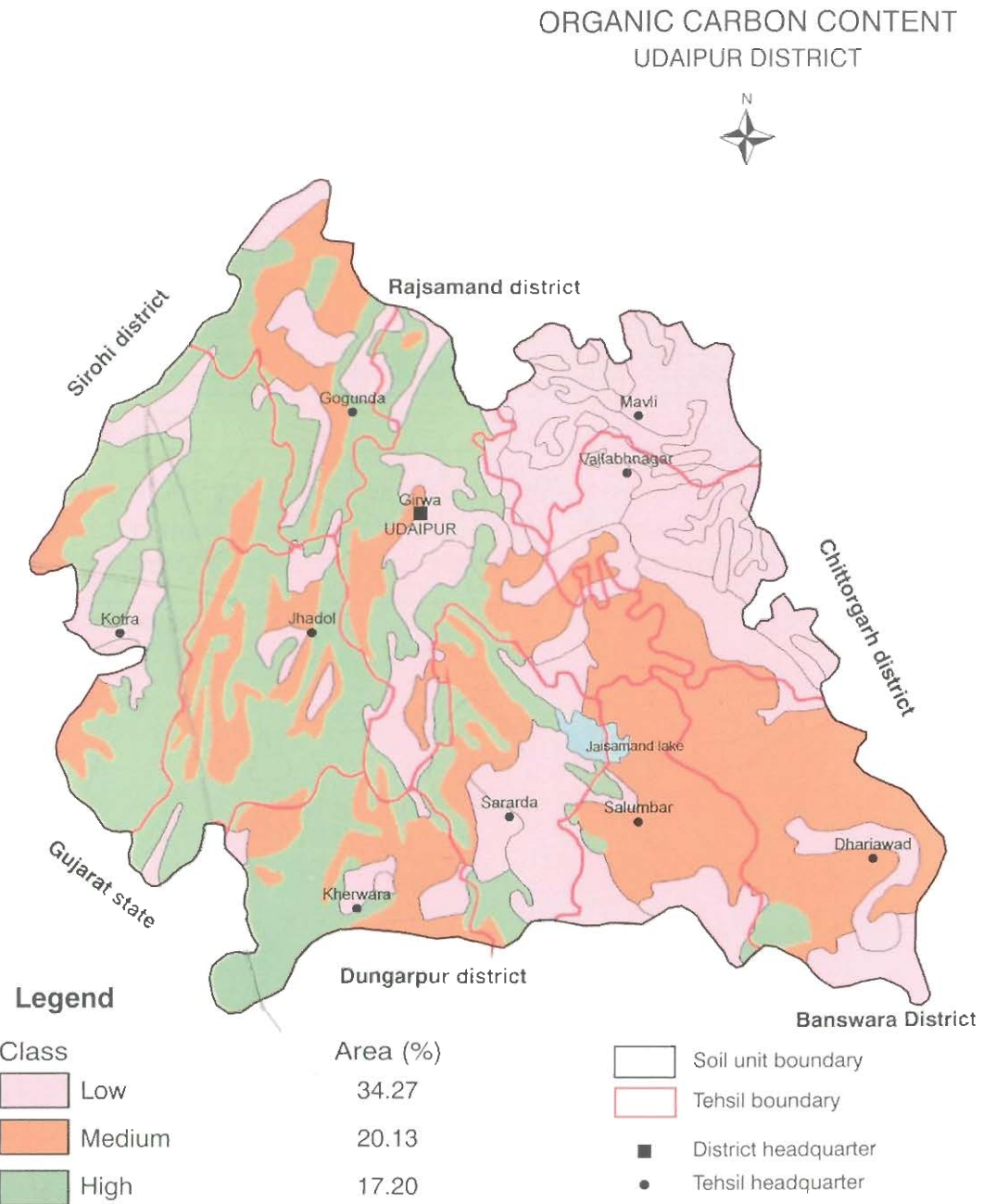


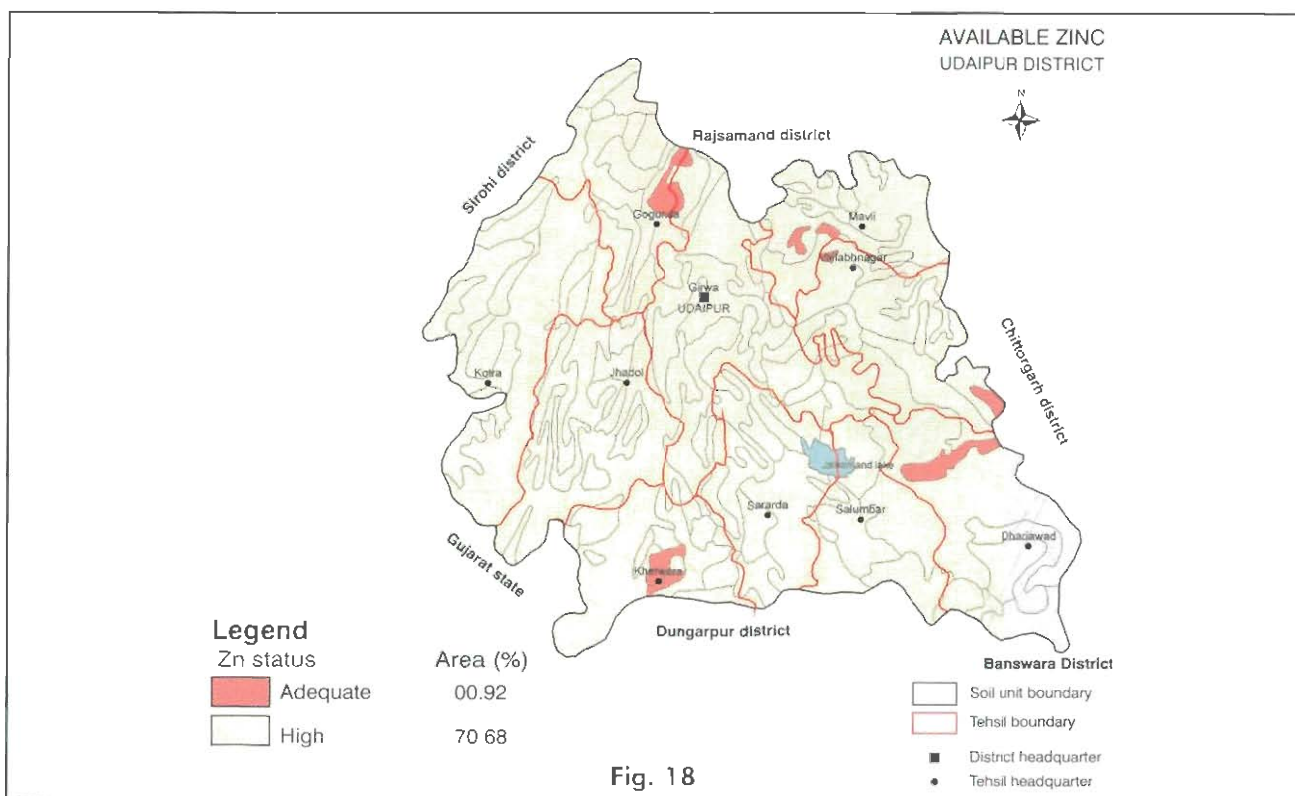
Fig. 17

Table 13. Organic carbon (OC) distribution in NPK for soils of Udaipur district (Area in ha)

Tehsil	Low OC (<0.50%)	Medium OC (0.50-0.75%)	High OC (>0.75%)	Samples	Nutrient Index		
					N	P	K
Dhariawad	27711	40891	9051	2,222	1.10	1.75	2.64
Gogunda	17322	24144	20610	831	1.02	1.89	2.88
Jhadol	13438	33988	38544	2,494	1.23	1.80	2.84
Kherwara	13672	36830	24730	1,433	1.08	1.89	2.61
Kotra	46645	20305	72802	1,322	1.08	1.86	2.86
Mavli	82591	0	321	2,358	1.15	1.78	2.71
Salumbar	45336	68458	2275	2,965	1.12	2.03	2.65
Sarada	104710	31540	32811	2,771	1.03	1.92	2.67
Girwa	69372	29367	50311	6,234	1.26	1.85	2.92
Vallabhnagar	80294	8833	0	1,902	1.04	1.81	2.74
Total (%)	501092 (34.27)	294356 (20.13)	251453 (17.20)	24,533	1.14	1.86	2.77

2.3.4 Micronutrients

Available Zinc and Manganese: Available zinc (Table 14 and Fig. 18) is generally high (>1.5 ppm) in the district in 70.7% and adequate in 0.9% area. Packets of available zinc in adequate range (0.75 to 1.5 ppm) occurs in Gogunda (3.1%), Kherwara (2.3%), Mavli (2.8%) and Vallabhnagar (4.4%)



tehsil. Available manganese (Fig. 19) is generally high (> 12.5 ppm) in the district in 71.4% area. Only 0.16% area of the district is low in available manganese in Vallabhnagar (2.3%) tehsil.

Table 14. Available Zinc and Manganese distribution in soils of Udaipur district (Area in ha)

Tehsil	Zinc (ppm)		Manganese (ppm)	
	Adequate (0.75-1.50)	High (>1.50)	Low (<7.5)	High (>12.5)
Dhariawad	0	77654	0	77654
Gogunda	2825	59251	0	62076
Jhadol	0	85971	0	85971
Kherwara	2507	72725	0	75233
Kotra	0	139753	0	139753
Mavli	2311	80601	0	82912
Salumbar	0	116070	0	116070
Sarada	0	169061	0	169061
Girwa	1311	147739	0	149050
Vallabhnagar	4513	84614	2368	86760
Total (%)	13467 (0.92)	1033438 (70.68)	2368 (0.16)	1044539 (71.44)

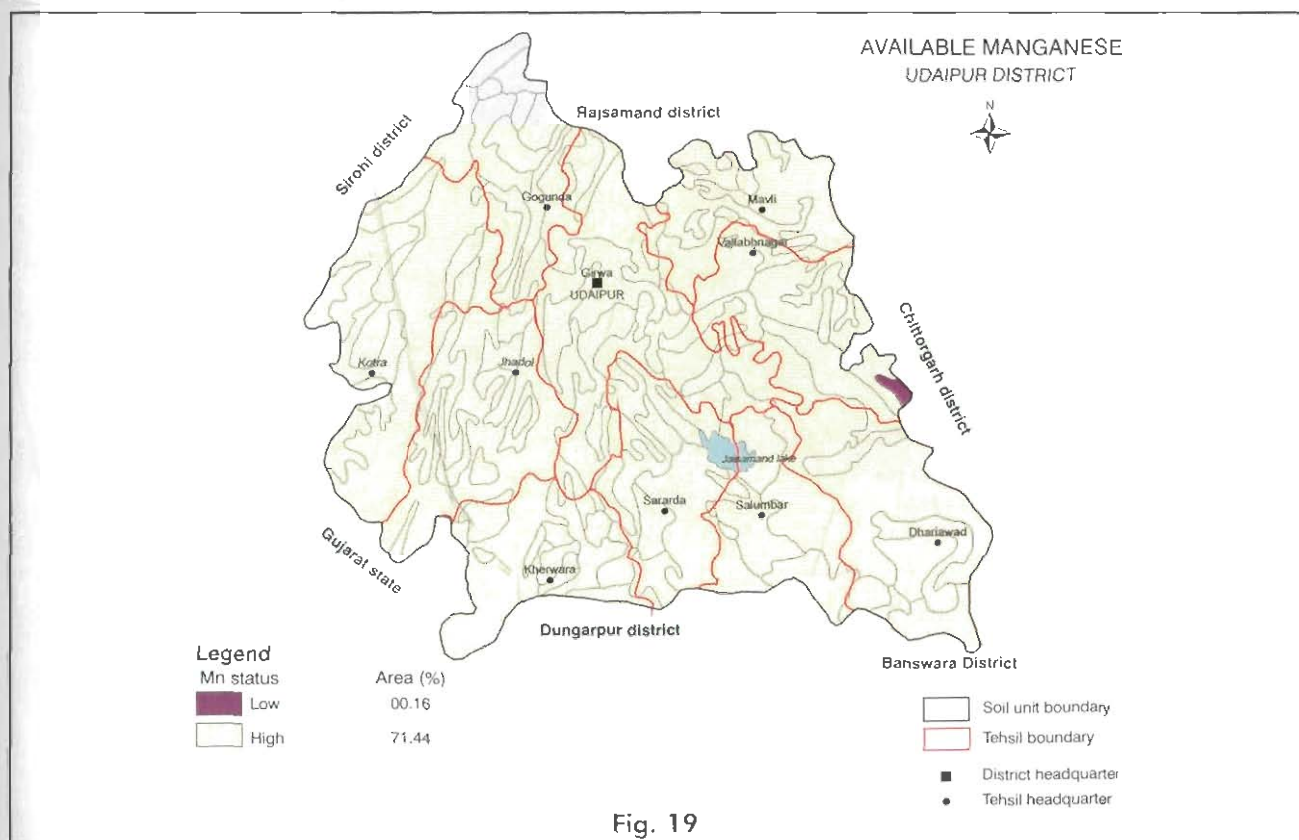
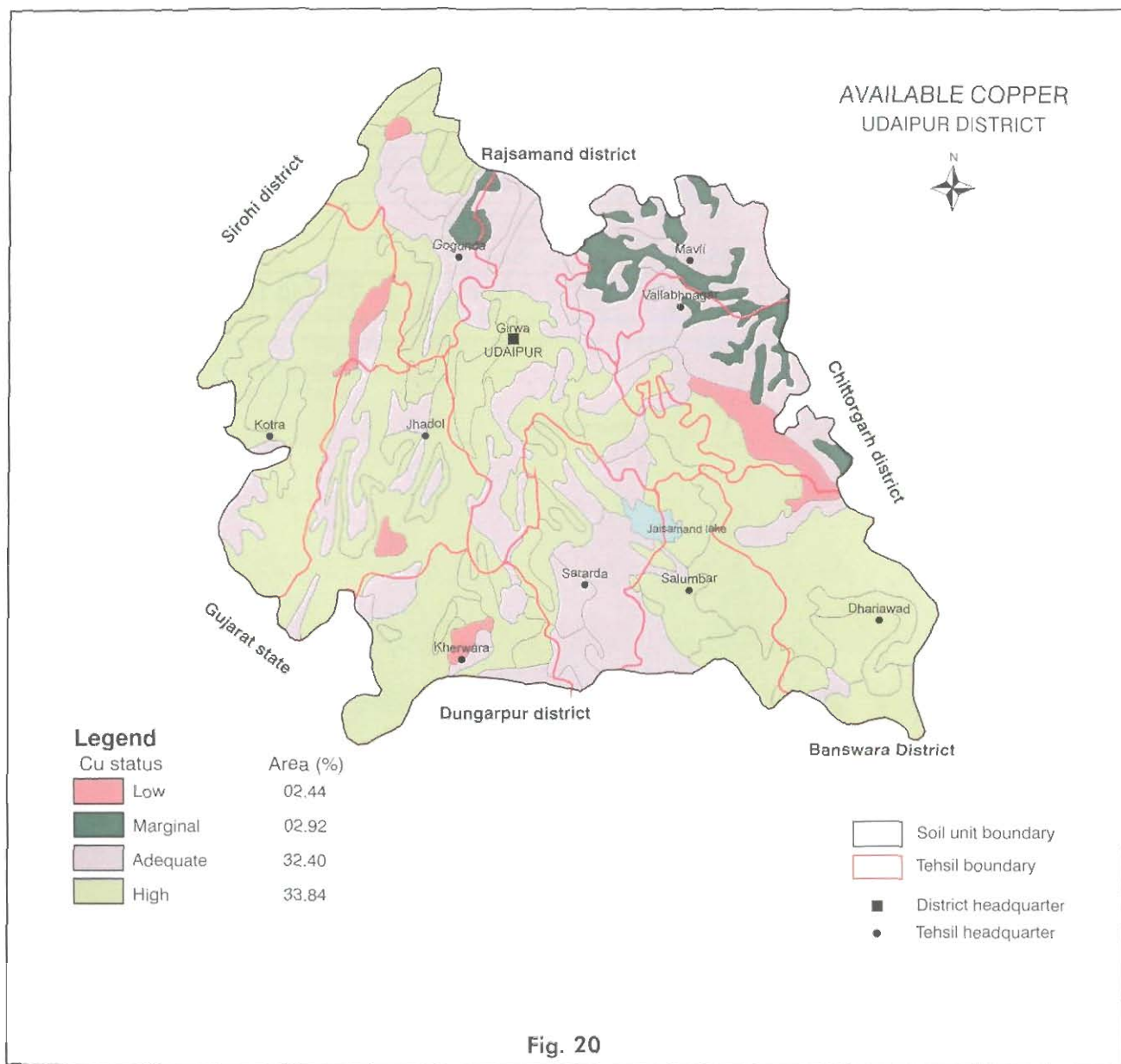


Fig. 19

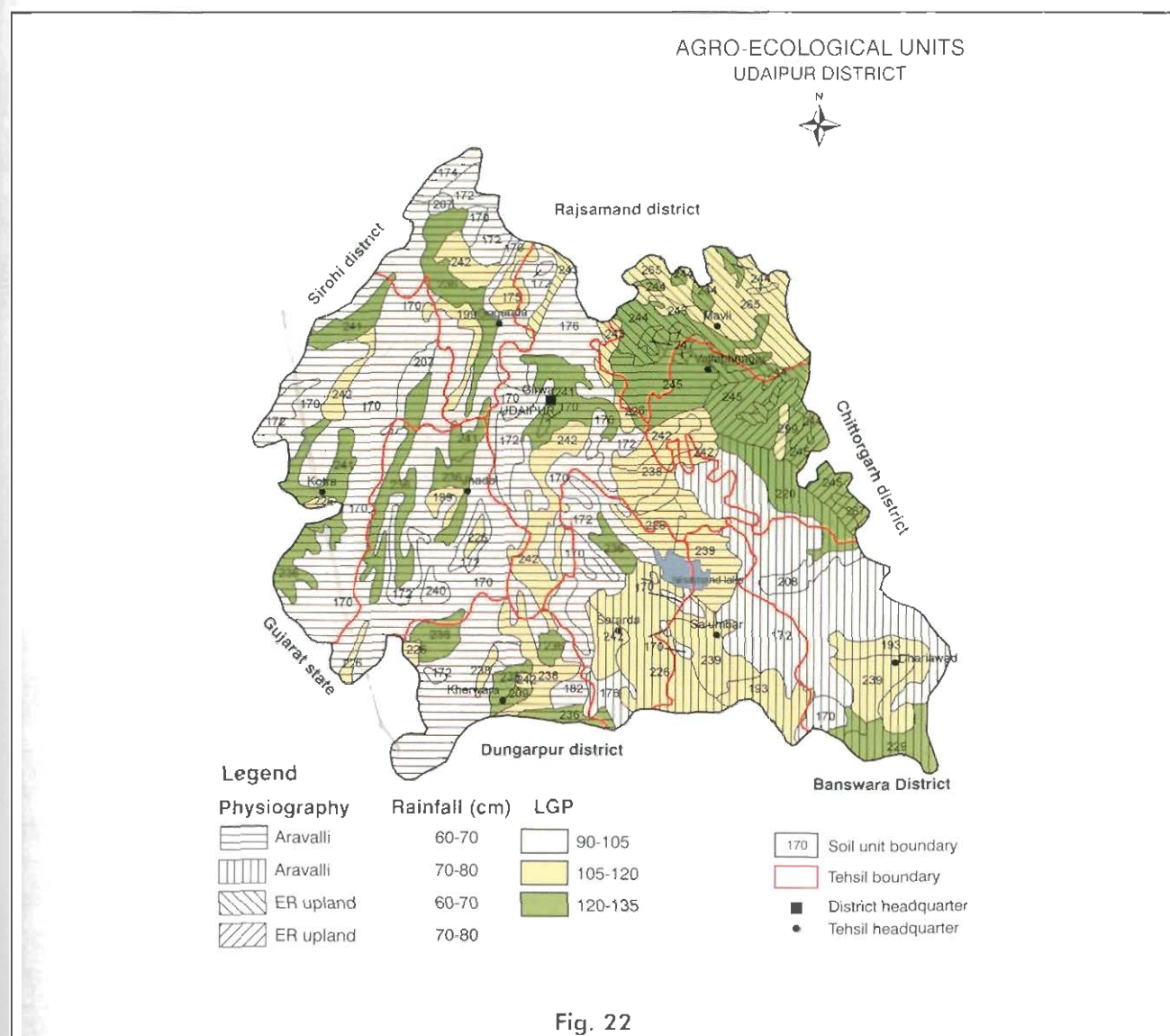
Available Copper: Available Copper (Table 15, Fig. 20) is generally adequate to high (>1.5 ppm) in 66.2% area and low to marginal in 5.4% area besides rock outcrops in 27.5% area. Pockets of low to marginal available copper occurs in Mavli (28.9%) and Vallabh nagar (24.0%) tehsil.

Available Iron: Available iron (Table 15 and Fig. 21) is generally adequate to high (>7.5 ppm) in 57.7% area, marginal (5.0 to 7.5 ppm) in 5.0% area and low (<5 ppm) in 8.2% area of the district. Pockets of low available iron occurs in Dhariawad (22.1%), Salumbar (48.4%) and Girwa tehsil (6.8%). Pockets of marginal available copper occurs in Sarada (8.6%), Girwa (17.6%) and Vallabh nagar (7.4%) tehsil.



3.2 Agroecological Units

Delineation and evaluation of homogeneous agroecological units at district level provides complete set of information on the edaphic situation. It may prove to be a better tool for optimising land use on sustainable basis. Agroecological unit map can be delineated by super imposing LGP map of 15 days interval on physiography and soil maps of the district on 1:250,000 scale, and assessed for their suitability for different crops. AEU map of the Udaipur district has been prepared by super imposing the variability of rainfall (10 cm) and LGP (15 days) on soil map on 1:250,000 scale. By this exercise 28 soil mapping units have been delineated as 72 agroecological units (Table 16 and Fig. 22). Each unit has been described in terms of site parameters including soil site characteristics, rainfall, length of growing period and available water capacity and assessed for their suitability for different crops.



AGROECOLOGICAL UNITS OF SOIL RESOURCES

3.1 Agroecological Approach

Agriculture is highly dependent on soils and climatic conditions. With the advancements in technical know-how, it has been realised that information on soils and crop-growing period may be pertinent in developing agro-ecological regions/zones as these parameters largely control the supply of water for plant growth. Agroecological approach considers soil-scape, bioclimate and length of growing period for sustainable land use planning and enable us to delineate the optimal areas for crop production and better management of natural resources.

Identification of homogeneous zones is necessary for proper utilization of land, water and other resources for development, crop planning, choice of crops in particular area and transfer of technology. Agroclimatic/Agroecological regions recognised are broad based. Each zone has large variation in rainfall, terrain, soil characteristics, surface and ground water potential and has different technological requirement. Therefore, it is necessary to classify the entire region into homogeneous agroecological zones and subzones so that a uniform package for development can be adopted. Zones are homogeneous with respect to potential and constraints for rainfall/irrigated cropping on soils, pasture and require specific technology for sustained development. With an aim to optimise land use for increased agricultural production on sustainable basis, it is essential to delineate agro-ecologically comparable resource regions for generating and transferring agro-technology to meet the increasing needs of food, fodder and fibre.

NBSS & LUP have huge database on soils and climate of the country, which form important component of agro-ecological zoning. The generalised maps of bio-climate, LGP and soilscape, are superimposed to generate various agro-ecological regions having fairly homogeneous physiography, soil, climate, natural vegetation and length of growing period (LGP). Broad 20 agro-ecological regions map and 60 agro-ecological subregions map of the country has been prepared by NBSS& LUP. Similarly soil based agro-ecological zone map of Rajasthan and agroecological unit maps of various districts have been prepared.

3.2 Agroecological Units

Delineation and evaluation of homogeneous agroecological units at district level provides complete set of information on the edaphic situation. It may prove to be a better tool for optimising land use on sustainable basis. Agroecological unit map can be delineated by super imposing LGP map of 15 days interval on physiography and soil maps of the district on 1:250,000 scale. and assessed for their suitability for different crops. AEU map of the Udaipur district has been prepared by super imposing the variability of rainfall (10 cm) and LGP (15 days) on soil map on 1:250,000 scale. By this exercise 28 soil mapping units have been delineated as 72 agroecological units (Table 16 and Fig. 22). Each unit has been described in terms of site parameters including soil site characteristics, rainfall, length of growing period and available water capacity and assessed for their suitability for different crops.

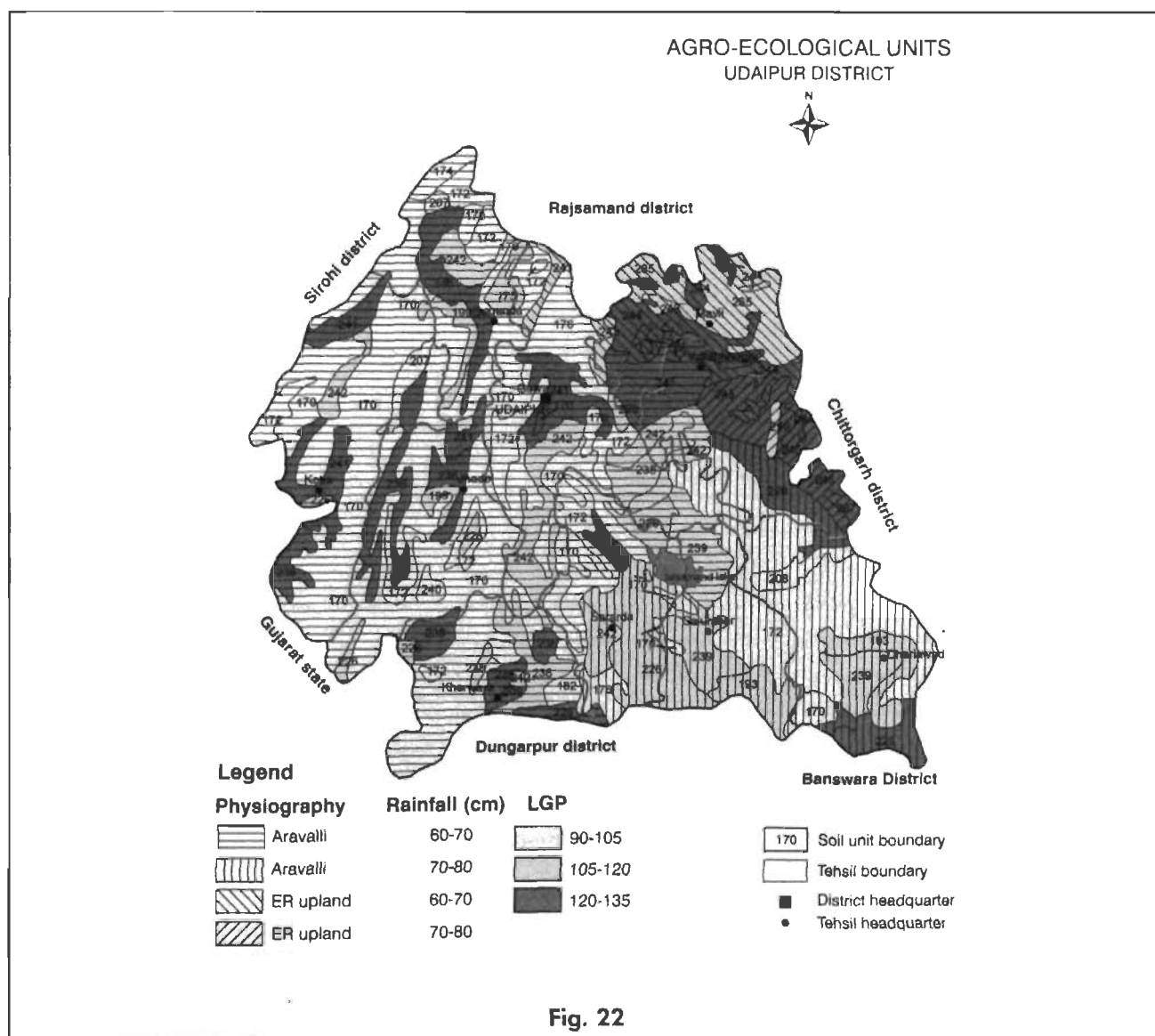


Table 16. Agroecological units of Udaipur district

Unit	Area (ha)	Rainfall (cm)	LGP (days)	Soil depth (cm)	Texture	Slope (%)	Stoniness erosion (%)	ECe dSm ⁻¹	ESP	AWC (mm)
Central Highland Aravalli landscape										
170A D	242280	60-70	90-105	ROCK				<2	<5	-
SD	161520		90-105	25-50	LSK	30-50	>40/S		<5	30
170B D	9120	70-80	90-105	ROCK					<5	-
SD	6080		90-105	25-50	LSK	30-50	>40/S		<5	30
172A D	55560	60-70	90-105	ROCK						-
SD	37040		105-120	50-75	fl	3-8	S			90
172B D	96420	70-80	90-105	ROCK						-
SD	64280		105-120	50-75	fl	3-8	S			90
174A D	46280	60-70	90-105	ROCK						-
SD	3120		90-105	50-75	LSK	15-30	>40/S			40
175A D	5820	60-70	105-120	25-50	L/L	3-8	15-40/M			60
SD	3880		90-105	ROCK						-
176A D	23160	60-70	90-105	<25	LSK/L	30-50	>40/S			20
SD	15440		120-135	>100	cL	1-3	M			120
176B D	3540	70-80	90-105	<25	LSK/L	30-50	>40/S			20
SD	2360		120-135	>100	cL	1-3	M			120
182A D	2700	60-70	90-105	<25	LSK/L	30-50	S			20
SD	1800		105-120	50-75	LSK	1-3	15-40/Vs			40
193B D	17760	70-80	105-120	50-75	fl/L	3-8	S			90
SD	11840		105-120	50-75	cL	3-8	S			70
199A D	7500	60-70	105-120	50-75	fl/L	3-8	M			90
SD	5000		90-105	50-75	LSK	8-15	15-40/S			40
207A D	5760	60-70	90-105	<25	LSK/L	8-15	>40/S			20
SD	3840		105-120	75-100	fl	3-8	M			90
208B D	5700	70-80	90-105	<25	LSK/L	8-15	>40/S			20
SD	3800		105-120	25-50	L	8-15	15-40/S			60
209A D	1080	60-70	120-135	>100	fl/L	3-8	S	<2		150
SD	720		105-120	50-75	fl	3-8	S			90
220B D	14880	70-80	120-135	>100	cL/L	3-8	15-40/S			120
SD	9920		90-105	ROCK						-
226A D	14460	60-70	105-120	50-75	fl/L	3-8	15-40/M	2-4	5-15	90
SD	9640		120-135	50-75	C	8-15	Sl	2-4	5-15	120
226B D	29820	70-80	105-120	50-75	fl/L	3-8	15-40/M	2-4	5-15	90
SD	19880		120-135	50-75	C	8-15	Sl	2-4	5-15	120
229B D	12720	70-80	120-135	75-100	fl/L	3-8	Sl			120
SD	8480		120-135	>100	fl	1-3	Sl			150

AGROECOLOGICAL UNITS OF SOIL RESOURCES

235A D	2820	60-70	120-135	>100	cL/L	1-3	M			120
SD	1880		105-120	>100	S	3-8	S			50
236A D	57780	60-70	120-135	75-100	fL/L	3-8	15-40/M			120
SD	38520		105-120	50-75	fL	1-3	M			90
236B D	5520	70-80	120-135	75-100	fL/L	3-8	15-40/M	<2		120
SD	3680		105-120	50-75	fL	1-3	M	<2		90
238A D	21660	60-70	105-120	50-75	fL/L	1-3	M	<2		90
SD	14440		105-120	50-75	fL	1-3	M	4-8		90
239B D	39660	70-80	105-120	50-75	fL/L	3-8	M	<2		90
SD	26440		105-120	50-75	cL	8-15	S	<2		70
240A D	2400	60-70	90-105	<25	LSK/L	15-30	>40/S	<2		20
SD	1600		120-135	75-100	fL	3-8	M	<2		120
241A D	36720	60-70	120-135	75-100	fL/L	3-8	M	<2		120
SD	24480		90-105	<25	L	8-15	S	<2		40
242A D	41160	60-70	105-120	50-75	fL/L	3-8	M	<2		90
SD	27440		90-105	<25	LSK	15-30	>40/S	<2		20
242B D	6720	70-80	105-120	50-75	fL/L	3-8	M	<2		90
SD	4480		90-105	<25	LSK	15-30	>40/S	<2		20
Eastern Rajasthan upland										
243A D	16740	60-70	105-120	50-75	fL/L	1-3	SI	4-8	5-15	90
SD	11160		105-120	75-100	cL	1-3	M	<2		90
244A D	6480	60-70	120-135	>100	fL/L	1-3	M	<2		150
SD	4320		105-120	50-75	fL	1-3	SI	4-8	<5	90
244B D	5340	70-80	120-135	>100	fL/L	1-3	M			150
SD	3560		105-120	50-75	fL	1-3	SI	4-8	<5	90
245A D	33600	60-70	120-135	>100	C/C	3-8	M			200
SD	22400		120-135	>100	C	1-3	SI	4-8	<5	200
245B D	25560	70-80	120-135	>100	C/C	3-8	M			200
SD	17040		120-135	>100	C	1-3	SI	4-8	<5	200
247A D	5340	60-70	120-135	>100	CL/L	1-3	SI	<2		120
SD	3560		120-135	>100	fL	3-8	M	<2		150
265A D	11700	60-70	105-120	50-75	fL/L	1-3	SI	<2		90
SD	7800		105-120	50-75	fL	8-15	M	15-25	<5	90
267B D	840	70-80	120-135	75-100	C/C	1-3	SI	<2		150
SD	560		120-135	>100	C	1-3	SI	<2		200
299B D	1440	70-80	105-120	50-75	fL/L	1-3	M	<2		90
SD	960		90-105	75-100	S	3-8	S	<2		40
	6000		Waterbodies and miscellenous							

D - Dominant soil, SD - Sub dominant soil

LAND EVALUATION

Soil suitability for crop production is based on soil properties affecting root ramification and supply of moisture and nutrients and other factors like topography and climate. Potentials and constraints of soil needs to be assessed and interpreted for better land use planning. USDA land capability classification, irrigability classification and FAO crop suitability evaluation are being used in interpretation of land use properties and land use planning.

4.1 Land capability classification (LCC)

LCC is the grouping of a land unit into defined classes based on the capability. It serves as a guide to assess suitability of the land for arable class (class I-IV), grazing and forestry (class V-VIII). Land capability classification of Udaipur district (Table 17 and Fig. 23) shows 25.8% and 24.8% area under LCC II and III (Good to moderate) suitable for cropping. In Aravalli region 44.7% area is under class II and III whereas in ER Upland 95.1% area is under class II. These areas can be considered as potential areas for cropping. According to USDA land capability classification, besides 27.5% rock outcrops, 17.1% area of the district mainly in Aravalli region is under class V - VIII and not suitable for cropping. This area can be utilized for pasture and perennial vegetation to minimize run off. In Salumbar (75.2%) and Dhariawad (55.1%) tehsil class II and III land predominate. In Gogunda (41.5%), Jhadol (32.3%), Kherwara (43.1%), Kotra (21.6%), Sarada (58.7%) and Girwa (49.1%) tehsil class II and III land are associated with rock outcrops and class V to VIII land.

Rock outcrops in Sarada, Jhadol and Gogunda tehsil are associated with class V land whereas soils of Dhariawad, Salumbar and part of Sarada and Girwa tehsil are associated with class III land, moderately suitable for cropping. Valley soils in Sarada, Jhadol and Gogunda tehsil and part of Sarada, Salumbar and Dhariawad tehsil are under class III land. Soils of Vallabhnagar, part of Mavli, Girwa and Salumbar tehsil are class II (good for cropping). Major land units in northern part of Mavli tehsil in ER upland are under class V to VIII and associated with class II land. South eastern part of Dhariawad has class II land associated with class I land. Potential areas for cultivation (class I and II) in Udaipur district are mainly in Mavli (79.9%) and Vallabhnagar (68.9%) tehsil with LCC index 72.0 and 65.2. LCC index is between 40 to 50 in Dhariawad, Salumbar, Sarada and Girwa tehsil and between 20-40 in other tehsil.

Table 17. Land capability class distribution of soils of Udaipur district (Area in ha)

Tehsil	Land capability class					LCC index
	I	II	III	IV	V-VII	
Dhariowad	4779	15538	51100	0	6237	40.6
Gogunda	0	19540	17860	4879	19797	35.5
Jhadol	0	18978	27602	3171	36219	27.9
Kherwara	0	28551	18952	2046	25684	36.5
Kotra	0	36868	15411	14379	73095	24.4
Mavli	0	66226	201	16292	193	72.0
Salumbar	0	29571	84224	0	2275	49.7
Sarada	0	25186	108683	280	34912	40.6
Girwa	0	69683	23093	8323	47951	48.8
Vallabh Nagar	3952	67095	15014	0	3066	65.2
Total (%)	8732 (0.60)	377235 (25.80)	362138 (24.77)	49370 (3.38)	249426 (17.06)	41.2

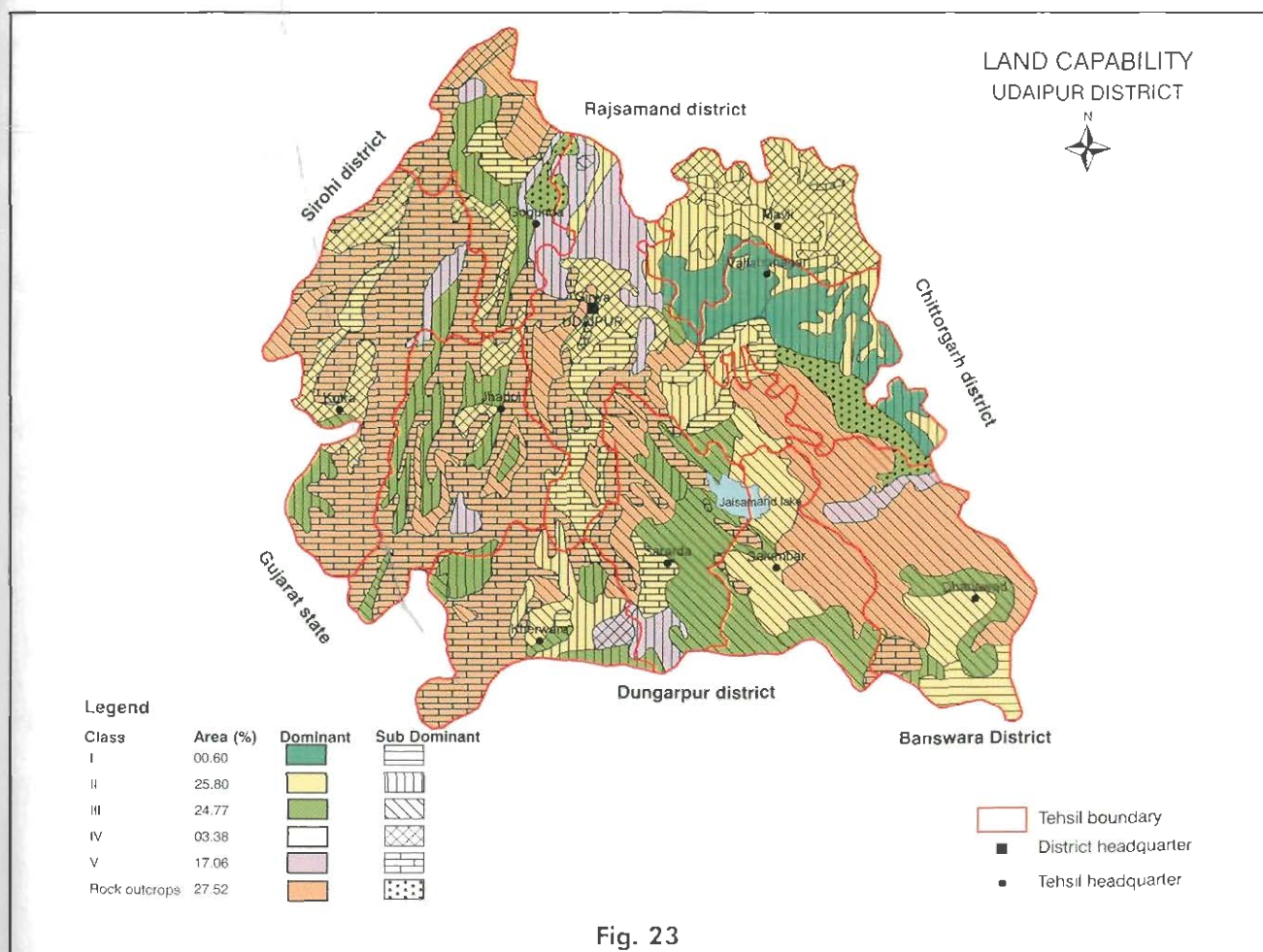


Fig. 23

4.2 Irrigation capability class (ICC)

Distribution of Irrigation capability class of soils of Udaipur district (Table 18 and Fig. 24) shows 50.5% area good to moderate (ICC 2-3) and 3.9% area marginally suitable (ICC 4) for irrigation. Besides 25.7% area under rock outcrops, 17.1% area is not suitable for irrigation. This area occurs mainly in Aravalli landscape in Kotra, Jhadol and part of Gogunda, Girwa and Kherwara tehsil. Rock outcrops in Salumbar, Dhariawad and part of Vallabhnagar and Sarada tehsil are associated with soils of ICC 3 (moderately suitable for irrigation). Valley soils in Kotra, Jhadol and Gogunda tehsil and part of Girwa, Mavli, Vallabhnagar, Sarada, Salumbar and Dhariawad tehsil are moderately suitable for irrigation and associated with class 2 land in Mavli and Vallabhnagar tehsil and class 3-4 land in Sarada and Salumbar tehsil. Part of Kherwara in Aravalli region and ER upland in Mavli tehsil have ICC 2 land. In northern part of Mavli tehsil ICC 2 (good) land is associated with ICC 4 land (marginally suitable for irrigation). From irrigation point of view the potential areas for irrigation are in Mavli and Vallabhnagar tehsil and in valleys in other tehsil. ICC index is 71.9 and 57.9 for Mavli and Vallabhnagar tehsil, between 40 to 50 for Salumbar, Sarada and Girwa tehsil and between 20 to 40 in other tehsils.

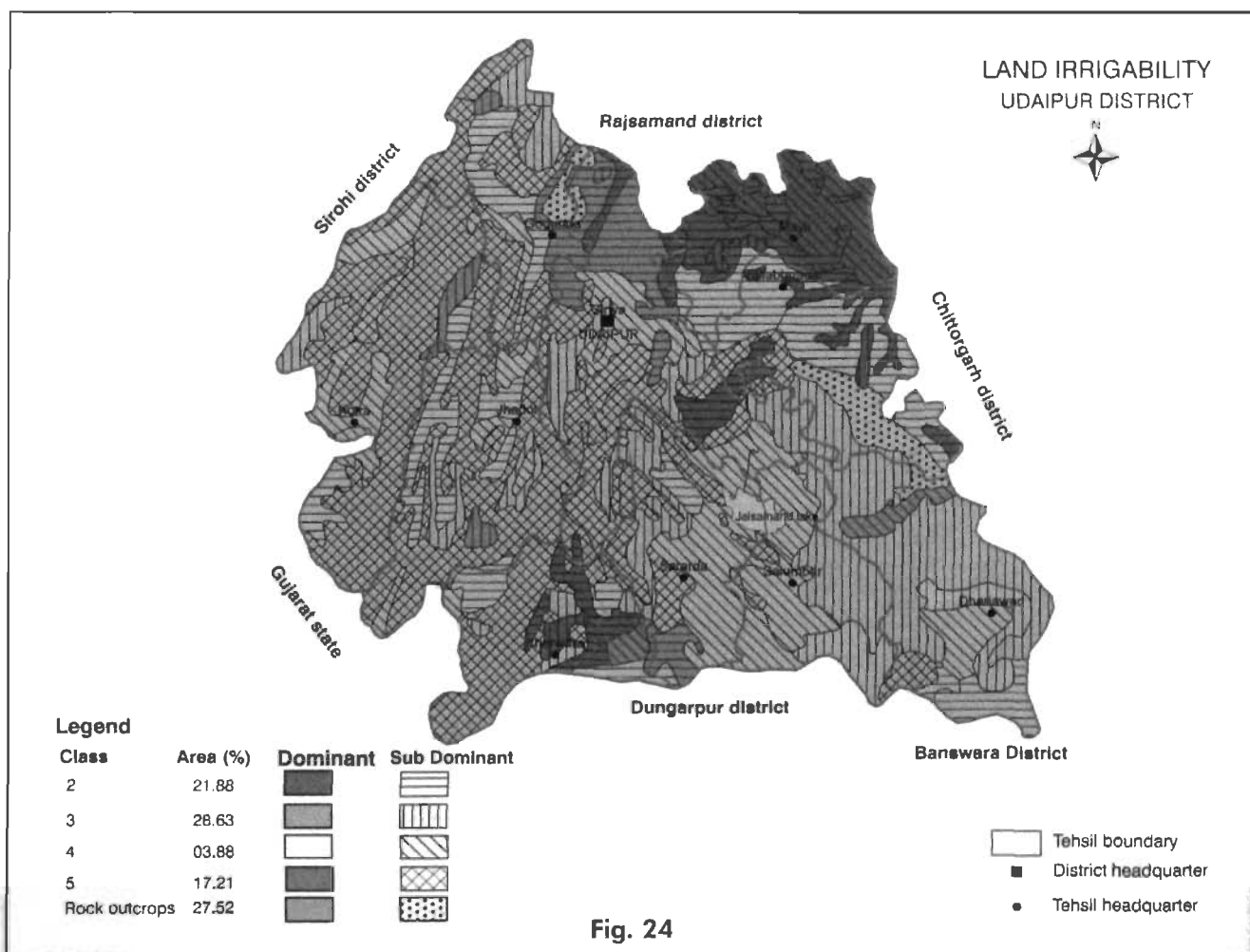


Table 18. Irrigation capability class distribution of soils of Udaipur district (Area in ha)

Tehsil	Irrigability capability class				
	2	3	4	5	ICC Index
Dhariawad	5683	57942	7791	6237	36.1
Gogunda	10304	27096	2662	22014	33.0
Jhadol	10713	34136	4902	36219	26.5
Kherwara	28551	18952	2046	25684	36.4
Kotra	36868	15411	14379	73095	24.0
Mavli	66226	201	16292	193	71.9
Salumbar	29571	84224	0	2275	49.3
Sarada	25186	108683	280	34912	40.6
Girwa	69683	23093	8323	47951	43.7
Vallabhnagar	37186	48876	0	3066	57.9
Total (%)	319970 (21.88)	418613 (28.63)	56675 (3.88)	251643 (17.21)	37.4

4.3 FAO crop suitability evaluation

The productivity of crops depends largely on the soil characteristics, climate and level of crop management. Land evaluation for crop suitability involves the interpretation of basic data on climate, soil and qualities of land which are crop specific and based on comparison of plant growth and production requirements. Crop growth requirements are defined in terms of impact of soil site characteristics on growth and production and specific values corresponding to optimal (no constraints) and progressively more marginal conditions and severe constraints.

Land suitability for different crops is assessed by matching the characteristics of mapping unit with crop requirements at different limitation level. The number and degree of limitation suggest the suitability class of each soil unit for a particular crop. Based on limitations of rainfall, LGP, depth, texture, salinity, surface conditions, etc. the limitation class for crops for individual parameters are

Limitations	Productivity
Slight	85%
Moderate	60%
Severe	40%
Very Severe	<40%

Overall suitability of mapping unit/AEU for different crops are being adjudged on the basis of following criteria

Suitability class	Limitations
S1 Highly Suitable	One moderate
S2 Moderately suitable	Two moderate or one severe
S3 Marginally suitable	Three moderate or two severe or one very severe limitation
N Not suitable	Three severe or two very severe limitations.

Overall suitability of soils for different crops in the region are calculated by summation of product of percent area in suitability class with productivity potential (suitable 0.85, moderately suitable 0.60, marginally suitable 0.4, not suitable 0.2)

$$\text{Suitability index} = \sum \% \text{ area in suitability class} \times \text{productivity potential}$$

NBSS & LUP has developed soil site suitability criteria for different crops in terms of suitable (S1), moderately suitable (S2), Marginally suitable (S3). Agroecological units have been evaluated for degree of limitation for major crops of Udaipur region to determine the crop suitability.

CROP SUITABILITY

Agroecological units of Udaipur district have been evaluated for major crops under rainfed and irrigated condition by FAO crop suitability approach by matching soil site characteristics with crop requirements.

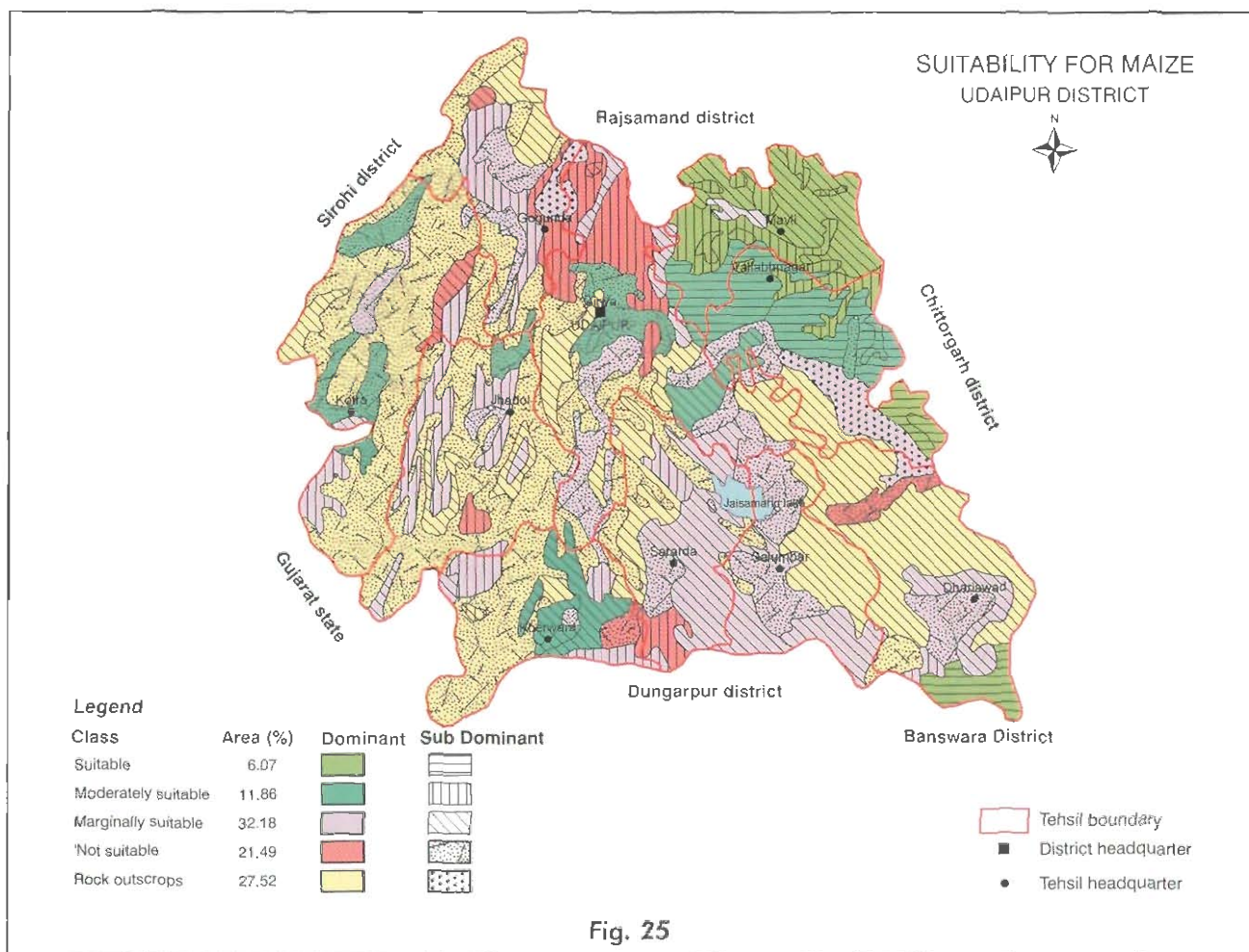
5.1 Suitability for maize

In Udaipur district (Table 19 and Fig. 25) 6.1 and 11.9% area are suitable and moderately suitable for maize whereas 32.2% area is marginally suitable. In Aravalli region only 10.4% area is suitable to moderately suitable for maize as compared to 79.5% area in ER upland. Marginally suitable area for maize is 31.6% in Aravalli as compared to 20.0% in ER upland. Area suitable for maize is highest in Mavli tehsil (53.7%) followed by Vallabhnagar (30.4%) and Dhariawad (9.9%). Moderately suitable area for maize is 31.5% in Vallabhnagar tehsil and between 10 to 20% in Gogunda, Jhadol, Kherwara, Kotra, Mavli and Girwa tehsil. Marginally suitable area for maize is between 40-60% in Dhariawad, Salumbar and Sarada tehsil and between 20 to 40% in Gogunda., Jhadol, Kherwara, Mavli, Girwa and Vallabhnagar tehsil. Suitability index for maize in Udaipur district is highest in Mavli tehsil (68.3) followed by Vallabhnagar (53.8). Suitability index for maize is lowest in Kotra (18.1) and Jhadol (20.6) and between 25 to 30 in other tehsils. Suitability index for maize in ER upland is much higher (65.6) as compared to Aravalli (24.7) region.

Rock outcrops in western part of the district in Kotra, Jhadol and Gogunda tehsil are not suitable for maize whereas rock outcrops in Salumbar and Dhariawad tehsil are associated with marginally suitable area for maize. Valley soils in Kotra, Jhadol and Gogunda tehsil are marginally suitable and associated with moderately suitable area for maize. Soils of Sarada tehsil are generally marginally suitable for maize. Soils of Vallabhnagar tehsil are generally moderately suitable and associated with suitable soils for maize. Mavli tehsil in ER upland has suitable area in northern parts and marginally suitable area in southern part associated with marginally suitable areas. Pockets of non suitable area in northern part of Girwa tehsil and part of Kherwara and part of Salumbar tehsil are associated with moderately suitable areas for maize. Part of Dhariawad tehsil adjoining Banswara district is suitable for maize.

Table 19. Suitability of soils of Udaipur district for maize

Tehsil	Suitability class				Suitability index
	Suitable	Moderate	Marginal	Not suitable	
	----- Area (ha) -----				
Dhariawad	11949	904	50773	14028	28.0
Gogunda	0	10579	26822	24675	24.2
Jhadol	0	15895	30685	39390	20.6
Kherwara	0	21977	25526	27730	26.3
Kotra	0	27492	24786	87474	18.1
Mavli	44554	17145	21020	193	68.3
Salumbar	0	0	94081	21989	27.8
Sarada	0	11822	121085	36153	27.6
Girwa	881	35025	54538	58605	29.3
Vallabhnagar	31357	32514	21222	4035	53.8
Total (%)	88741(6.07)	173353(11.86)	470538(32.18)	314270(21.49)	29.6



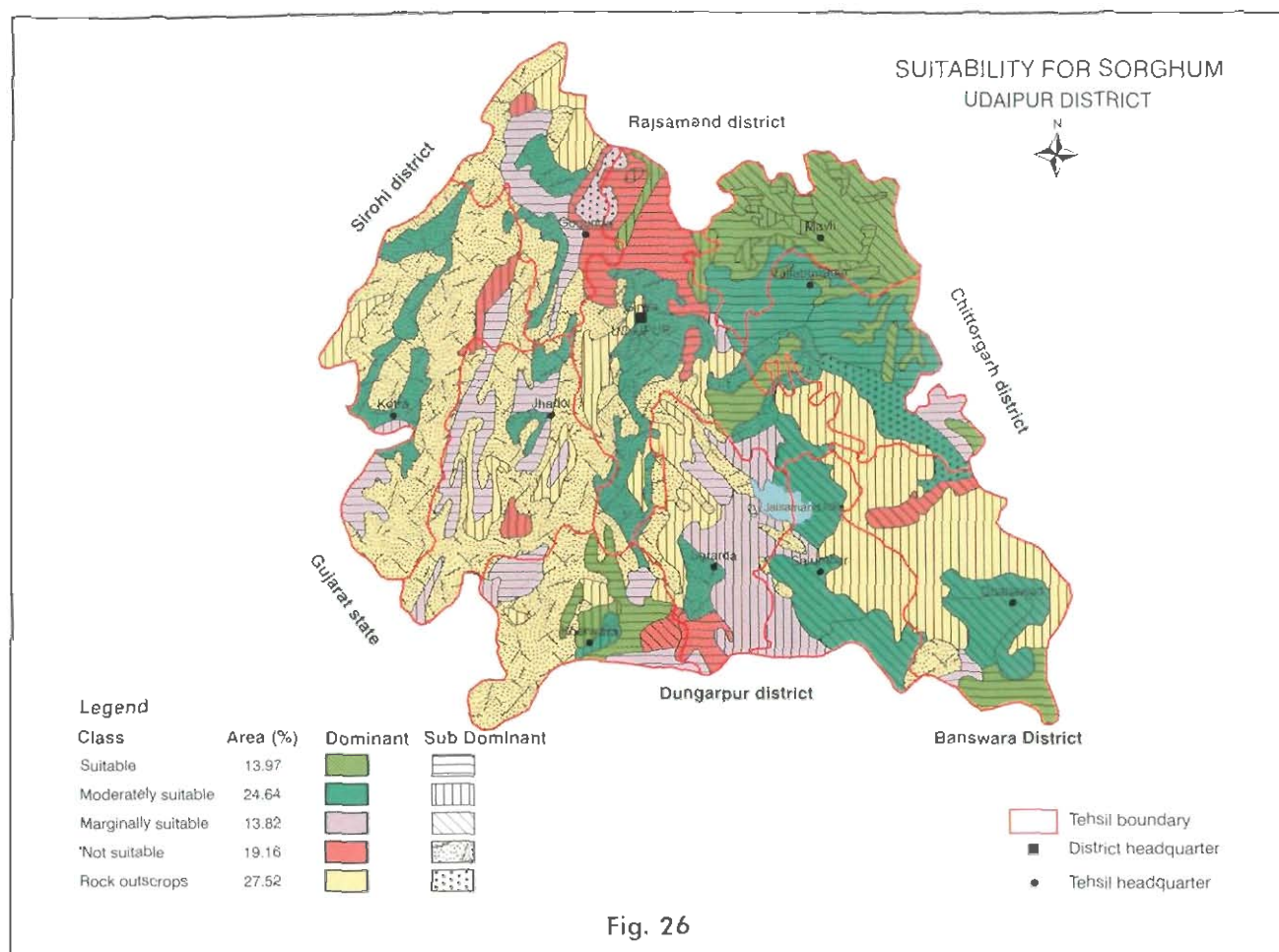
5.2 Suitability for sorghum

In Udaipur district (Table 20 and Fig. 26) 38.6% area is suitable to moderately suitable for sorghum and 13.8% is marginally suitable. In Aravalli region 33.2% area is suitable to moderately suitable for sorghum whereas in ER upland 95.1% is suitable to moderately suitable. Suitability index for sorghum in ER upland (72.5) is high as compared to Aravalli region (31.5). Area suitable for sorghum is highest in Mavli (68.7%) followed by Vallabhnagar (36.0%), Kherwara (24.8%) and between 10 to 20% in Dhariawad, Gogunda and Girwa tehsil. Moderately suitable area for sorghum is between 30 to 50% in Dhariawad, Salumbar and Vallabhnagar tehsil and between 20 to 30% in Sarada and Girwa tehsil. Marginally suitable area for sorghum is 26-28% in Salumbar and Sarada tehsil. Suitability index for Sorghum is highest in Mavli tehsil (73.1) followed by Vallabhnagar (58.7). Suitability index for sorghum is lowest in Kotra (19.9) and in between 24 to 40 in other tehsils.

In Mavli and Kherwara tehsil most of the area is suitable for sorghum with moderate to marginally suitable associated soils. Moderate to marginally suitable soils in part of Kherwara, Dhariawad and Girwa tehsil have suitable area for sorghum. Soils of Vallabhnagar tehsil are moderately suitable for sorghum associated with suitable soils. Part of Dhariawad and Salumbar have moderately suitable area for sorghum associated with marginally suitable soils. Valley soils in Kotra, Jhadol and Gogunda tehsil are moderately suitable for sorghum and associated with suitable soils. In Girwa and Kotra tehsil, valley soils are moderately suitable for sorghum associated with non suitable area. Rock outcrops in Salumbar and Dhariawad tehsil are associated with moderately suitable area for sorghum. Rock outcrops in Kotra, Jhadol and Gogunda tehsil are not suitable for cropping. Dominant soils of northern part of Girwa and part of Dhariawad and Sarada tehsil are not suitable for sorghum however associated soils are suitable to moderately suitable.

Table 20. Suitability of soils of Udaipur district for sorghum (Area in ha)

Tehsil	Suitability class				Suitability index
	Suitable	Moderate	Marginal	Not suitable	
Dhariawad	12852	43700	14864	6237	36.6
Gogunda	10213	14024	13163	24675	30.1
Jhadol	10713	17201	18666	39390	24.1
Kherwara	27296	8555	13697	25684	35.3
Kotra	6616	34707	10956	87474	19.9
Mavli	56999	9307	16413	193	73.1
Salumbar	0	71665	42130	2275	39.9
Sarada	12001	62131	60016	34912	34.4
Girwa	30405	55088	7281	56274	38.8
Vallabhnagar	37186	43954	4921	3066	58.7
Total (%)	204282 (13.97)	360333 (24.64)	202107 (13.82)	280178 (19.16)	36.3



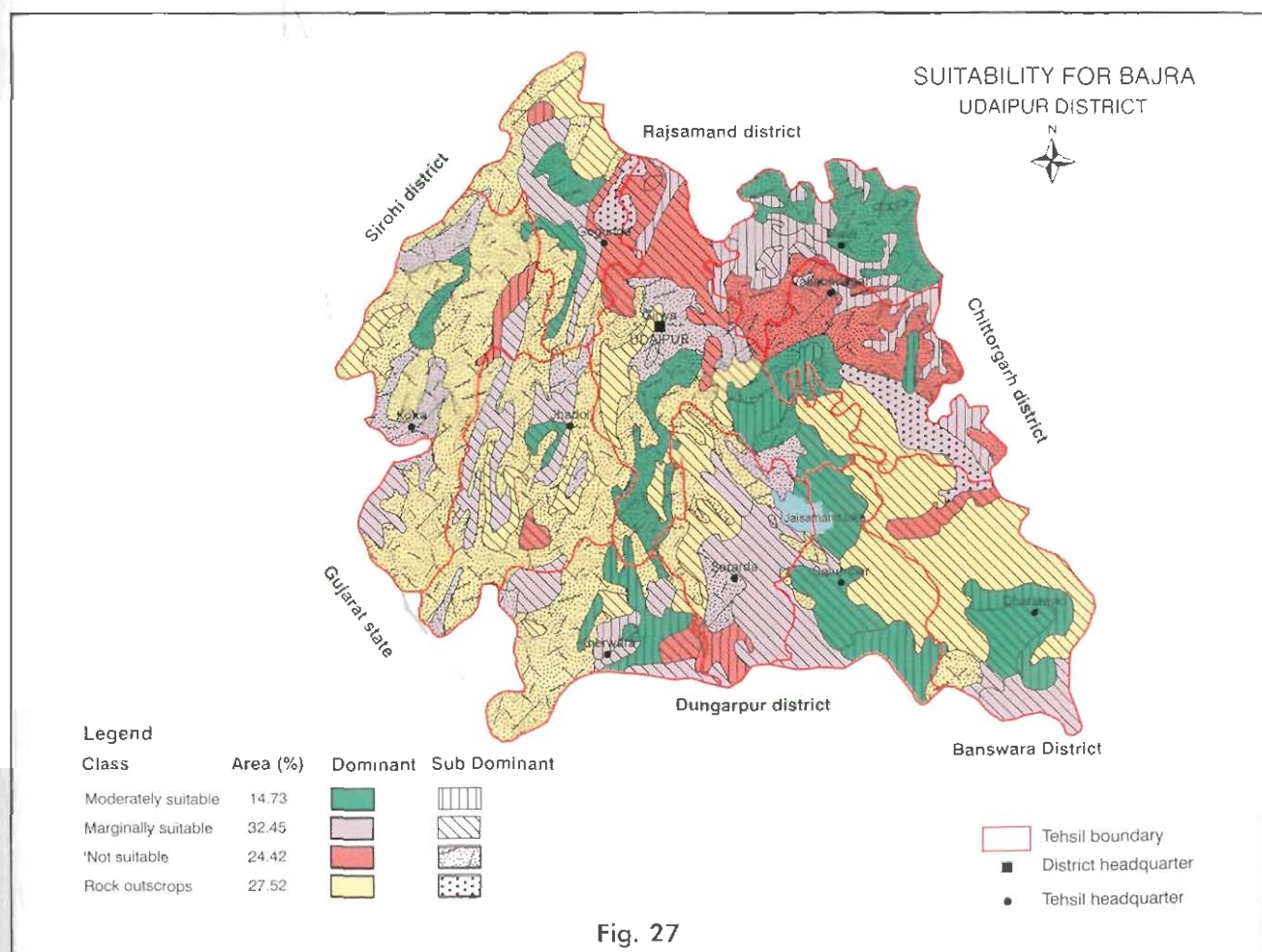
5.3 Suitability for bajra

In Udaipur district (Table 21 and Fig. 27) 14.7% area is moderately suitable for bajra with 12.7% in Arovalli and 18.6% of ER Upland. Marginally suitable area for bajra in Udaipur district is 32.4% with 32.5% in Aravalli region and 21.0% in ER upland. Suitability index for ER upland is 31.6 as compared to 25.0 for Aravalli region. Moderately suitable area for bajra is 43.2% in Mavli tehsil, 35.4% in Salumbar followed by 17-19% in Dhariawad, Kherwara, Girwa and Vallabhnagar tehsil. Marginally suitable area for bajra is 52% in Sarada tehsil and 20-30% in Jhadol, Kherwara, Mavli, Girwa and Vallabhnagar tehsil. Suitability index is high in Mavli (42.0) and Salumbar (37.5) and lowest in Jhadol and Kotra (16-19) and between 27 to 29 in Dhariawad, Gogunda, Kherwara, Sarado, Girwa and Vallabhnagar tehsil.

Port of Dhariawad and Salumbar tehsil is moderately suitable and associated with marginally suitable area. Dominant soils of Mavli and Girwa tehsil are moderately suitable for bajra. Valley area of Kotra, Jhadol, Gogunda and Sarada tehsil are marginally suitable for bajra. Rack outcrops in Kotra, Jhadol and Gogunda tehsil are not suitable for bajra whereas associated soils with rock outcrops in Dhariawad and Salumbar tehsil are marginally suitable for bajra. Soils of Vallabhnagar tehsil and western part of Girwa tehsil are not suitable for bajra.

Table 21. Suitability of soils of Udaipur district for bajra (Area in ha)

Tehsil	Suitability class			Suitability index
	Moderate	Marginal	Not suitable	
Dhariawad	21757	49659	6237	28.2
Gogunda	8825	30902	22348	29.7
Jhadol	3083	43179	39708	18.8
Kherwara	20602	28204	26425	26.3
Kotra	9376	42675	87701	16.6
Mavli	35850	19677	27385	42.0
Salumbar	53501	60293	2275	37.5
Sarada	9227	120405	39428	27.0
Girwa	35628	52519	60902	28.9
Vallabhnagar	17586	26969	44573	29.3
Total	215436 (14.73)	474484 (32.45)	356982 (24.42)	25.7



5.4 Suitability of sesame

In Udaipur district (Table 22 and Fig. 28) 49.7% area is moderately suitable for sesame constituting 44.6% area of Aravalli and 95.1% area of ER upland. Soils of Dhariawad, Salumbar, Sarada, Kherwara, Vallabhnagar and Mavli tehsil except rock outcrops are moderately suitable for sesame. Suitability index for sesame in ER upland is high (58.1) as compared to Aravalli region (31.9). Moderately suitable area for sesame is 75-82% in Mavli, Salumbar and Vallabhnagar tehsil, 40-60% in Dhariawad, Kherwara, Sarada and Girwa tehsil and 20-40% in Gogunda, Jhadol and Kotra, tehsil. Suitability index for sesame is high (45 to 50) in Mavli, Salumber and Vallabhnagar tehsil, between 30 to 40 in Dhariawad, Kherwara, Sarada and Girwa tehsil and low (20-30) in Gogunda, Jhadol and Kotra tehsil. Associated soils with rock outcrops in Dhariawad and Salumbar tehsil are moderately suitable. Associated soils in northern parts of Mavli tehsil, part of northern part of Girwa tehsil and rock outcrops in Kotra, Girwa, Jhadol and Gogunda tehsil are not suitable for sesame. Valley soils in Kotra, Jhadol and Gogunda tehsil are moderately suitable for sesame.

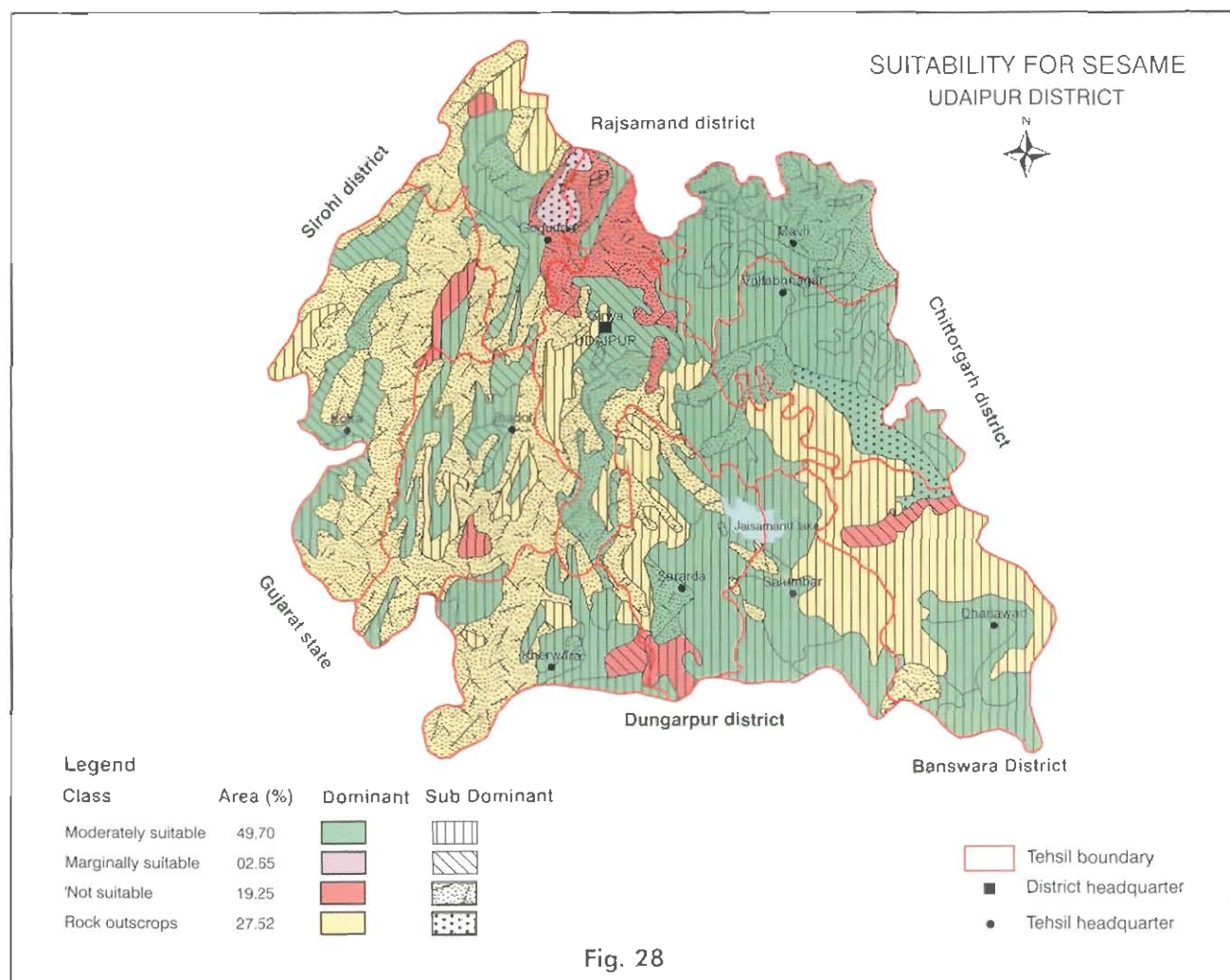


Table 22. Suitability of soils of Udaipur district for sesame (Area in ha)

Tehsil	Suitability class			Suitability index
	Moderate	Marginal	Not suitable	
Dhariawad	68602	2815	6237	36.0
Gogunda	33033	5486	23556	29.4
Jhadol	46580	3171	36219	25.8
Kherwara	47503	2046	25684	31.3
Kotra	52278	14379	73095	21.4
Mavli	66299	0	16613	48.4
Salumbar	113794	0	2275	45.4
Sarada	133868	280	34912	35.4
Girwa	79570	9634	59845	31.7
Vallabhnagar	85093	969	3066	50.4
Total	726620 (49.70)	38780 (2.65)	281501 (19.25)	35.1

5.5 Suitability for castor

In Udaipur district (Table 23 and Fig. 29) 10.1 and 29.4% area are suitable and moderately suitable for castor which constitute 35.4% area of Aravalli and 86.1% area of the ER upland. Suitability index for castor is 64.5 in ER upland as compared to 31.0 in Aravalli region. In Mavli tehsil 51.8 % area is suitable for castor as compared to 10-20% in Dhariawad, Gogunda, Kherwara and Vallabhnagar tehsil. Moderately suitable area for castor constitutes 35-60% in Dhariawad, Salumbar and Vallabhnagar, 25 to 40% in Mavli and Girwa tehsil and 15 to 25% in Gogunda, Jhadol, Kherwara, Kotra, and Sarada tehsil. Marginally suitable area for castor is 27.2% in Salumbar and 37.5% in Sarada tehsil. Suitability index for castor is high in Mavli (65.0) and Vallabhnagar (52.3) and between 30 to 40 in Dhariawad, Gogunda, Kherwara, Salumbar, Sarada and Girwa tehsil. Suitability index for castor is low in Kotra (20.8) and Jhadol (26.5) tehsil.

Dominant soils of Mavli tehsil and part of Dhariawad, Kherwara, Girwa and Vallabhnagar tehsil are suitable for castor whereas associated soils are suitable to moderately suitable for castor except Mavli tehsil. Soils of Vallabhnagar and part of Dhariawad, Salumbar, Girwa and valley soils of Kotra, Jhadol and Gogunda are moderately suitable for castor associated with suitable to moderately suitable soils. Soils of Sarada are marginally suitable. Associated soils with rock outcrops in Dhariawad and Salumbar tehsil are moderately suitable. Rock outcrops along with associated soils in Kotra, Jhadol and Gogunda tehsil are not suitable for castor.

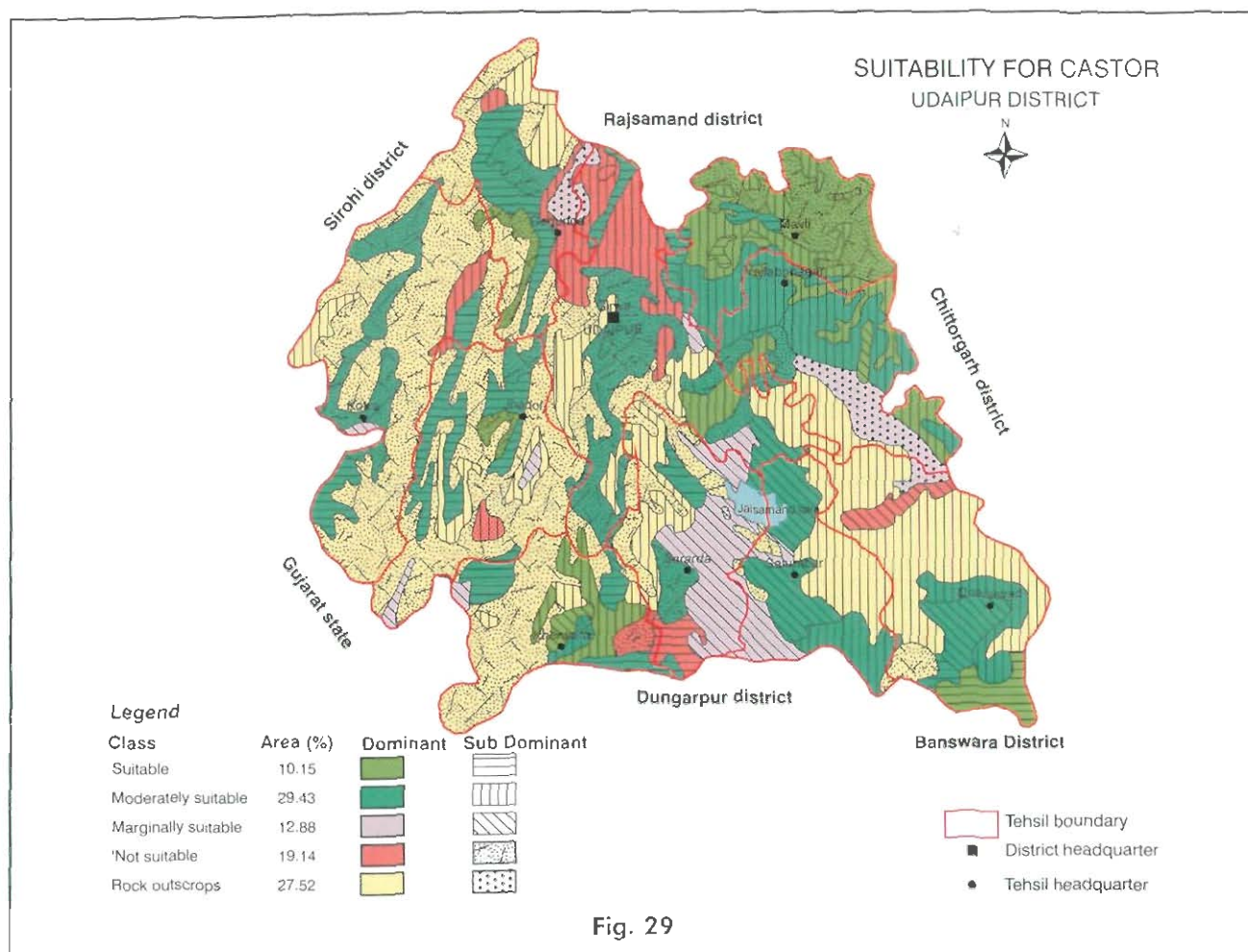


Table 23. Suitability of soils of Udaipur district for castor (Area in ha)

Tehsil	Suitability class				Suitability index
	Suitable	Moderate	Marginal	Not suitable	
Dhariawad	12852	49303	9261	6236	37.6
Gogunda	12116	22459	21711	5789	37.0
Jhadol	12832	29421	4327	39390	26.5
Kherwara	20473	23330	3699	27730	34.9
Kotra	7307	43249	1721	87474	20.8
Mavli	42962	23264	201	16485	65.0
Salumbar	0	72675	41120	2275	39.7
Sarada	11822	36646	85400	35192	32.2
Girwa	12153	70914	9708	56274	36.0
Vallabhnagar	15824	59063	11175	3066	52.3
Total (%)	148342 (10.15)	430325 (29.43)	188325 (12.88)	279910 (19.14)	35.0

5.6 Suitability for sunflower

In Udaipur district (Table 24 and Fig. 30) 26.0 and 22.1% area is suitable and moderately suitable for sunflower which constitute 41.8% area of Aravalli and 91.8% area of ER upland with suitability index 26.8 and 79.4 respectively. Suitable area for sunflower is high in Mavli (79.9%) and Vallabhnagar (67.9%) tehsil followed by 36.9% in Girwa and 15 to 25% in Dhariawad, Gogunda, Kherwara and Salumbar tehsil. Moderately suitable area for castor is 35-50% in Dhariawad, Salumbar and Sarada tehsil and 15-20% in Gogunda and Kherwara tehsil. Suitability index is high in Mavli (72.0) and Vallabhnagar (65.6), between 35 to 45 in Dhariawad, Gogunda, Kherwara, Salumbar, Sarada and Girwa tehsil and low in Jhadol (28.5) and Kotra (24.9) tehsil.

Soils of northern part of Vallabhnagar tehsil are suitable for sunflower. Dominant soils of Mavli tehsil and associated soils of southern part are suitable for sunflower whereas northern part are not suitable. Part of Dhariawad, Salumbar and Kherwara tehsil are suitable for sunflower associated with suitable to moderately suitable soil. Major portion of Girwa tehsil are suitable, however, associated soils are generally not suitable. Soils of Sarada and southern part of Salumbar and valley soils in Gogunda, Kotra and Jhadol tehsil are moderately suitable for sunflower and associated with suitable to moderately suitable soils for sunflower. Associated soils with rock outcrops in Salumbar and Dhariawad tehsil are moderately suitable whereas associated soils with rock outcrops in Kotra, Jhadol and Gogunda tehsil are not suitable. Major soils of the northern part of Girwa are not suitable for sunflower however, the associated soils are suitable.

Table 24. Suitability of soils of Udaipur district for sunflower (Area in ha)

Tehsil	Suitability class				Suitability index
	Suitable	Moderate	Marginal	Not suitable	
Dhariawad	20317	41838	9261	6236	39.1
Gogunda	18866	18535	4879	19797	36.4
Jhadol	18725	27855	3171	36219	28.5
Kherwara	28551	18952	2046	25684	37.7
Kotra	33570	18708	14379	73095	24.9
Mavli	66226	201	0	16485	72.0
Salumbar	29571	64510	19714	2275	45.1
Sarada	25186	107722	1241	34912	41.1
Girwa	69683	20762	10654	47951	38.9
Vallabhnagar	70079	4808	11175	3066	65.5
Total	380772	323891	76520	265718	41.7
(%)	26.04	22.15	5.23	18.17	

Table 25. Suitability of soils of Udaipur district for cowpea (Area in ha)

Tehsil	Suitability class				Suitability index
	Suitable	Moderate	Marginal	Not suitable	
Dhariawad	5683	57942	7791	6237	36.3
Gogunda	14737	19702	2961	24675	33.6
Jhadol	13968	28285	4009	39708	26.6
Kherwara	23231	20572	3699	27730	35.5
Kotra	12001	38556	1721	87474	21.3
Mavli	49581	13928	2917	16485	66.3
Salumbar	0	72675	41120	2275	40.0
Sarada	23565	24903	85400	35192	33.4
Girwa	44516	34309	13950	56274	33.9
Vallabhnagar	43906	41187	969	3066	61.1
Total	231189	352059	164539	299114	37.3
(%)	15.81	24.08	11.25	20.46	

5.8 Suitability for beans

Moong and Urd are major pulses besides cowpea in Udaipur district. In the district (Table 26 and Fig. 32) 33.1% and 10.7% area are suitable to moderately suitable for beans which constitute 41.7% area of Aravalli and 59.2% area of ER upland with suitability index of 39.9 and 57.2 respectively. Suitable area for beans is 48 – 52% in Dhariawad, Mavli and Salumbar tehsil, between 30-40% in Gogunda, Jhadol, Kherwara and Girwa tehsil and 20% in Kotra, Sarada and Vallabhnagar tehsil. Moderately suitable area is 38.8% in Vallabhnagar and 20% in Salumbar and Sarada tehsil. Marginally suitable area is 20-25% in Mavli and Vallabhnagar tehsil and 10-15% in Kherwara, Sarada and Girwa tehsil. Suitability index is 50-60 in Dhariawad, Mavli, Salumbar and Vallabhnagar tehsil and 30 to 45 in remaining tehsils.

Major soils of northern part of Mavli tehsil are suitable for beans, however, associated soils are not suitable. Soils of part of Dhariawad, Salumbar and Kherwara tehsil are suitable for beans and associated soils are suitable to moderately suitable. Valley soils of Girwa tehsil are suitable for beans and associated soils are only marginal to not suitable. Soils of Vallabhnagar tehsil and part of Sarada tehsil are moderately suitable and associated with marginally suitable soils for beans. Valley soils of Kotra, Jhadol and Gogunda tehsil are suitable for beans. Associated soils with rock outcrops in Dhariawad and Salumbar tehsil are suitable for beans whereas associated soils with rock outcrops in Kherwara, Kotra and Jhadol tehsil are not suitable. Associated soils in northern part of Gogunda tehsil have suitable area for beans. Northern part of Girwa and pockets in Kherwara, Kotra and Dhariawad are not suitable for beans, whereas associated soils are suitable.

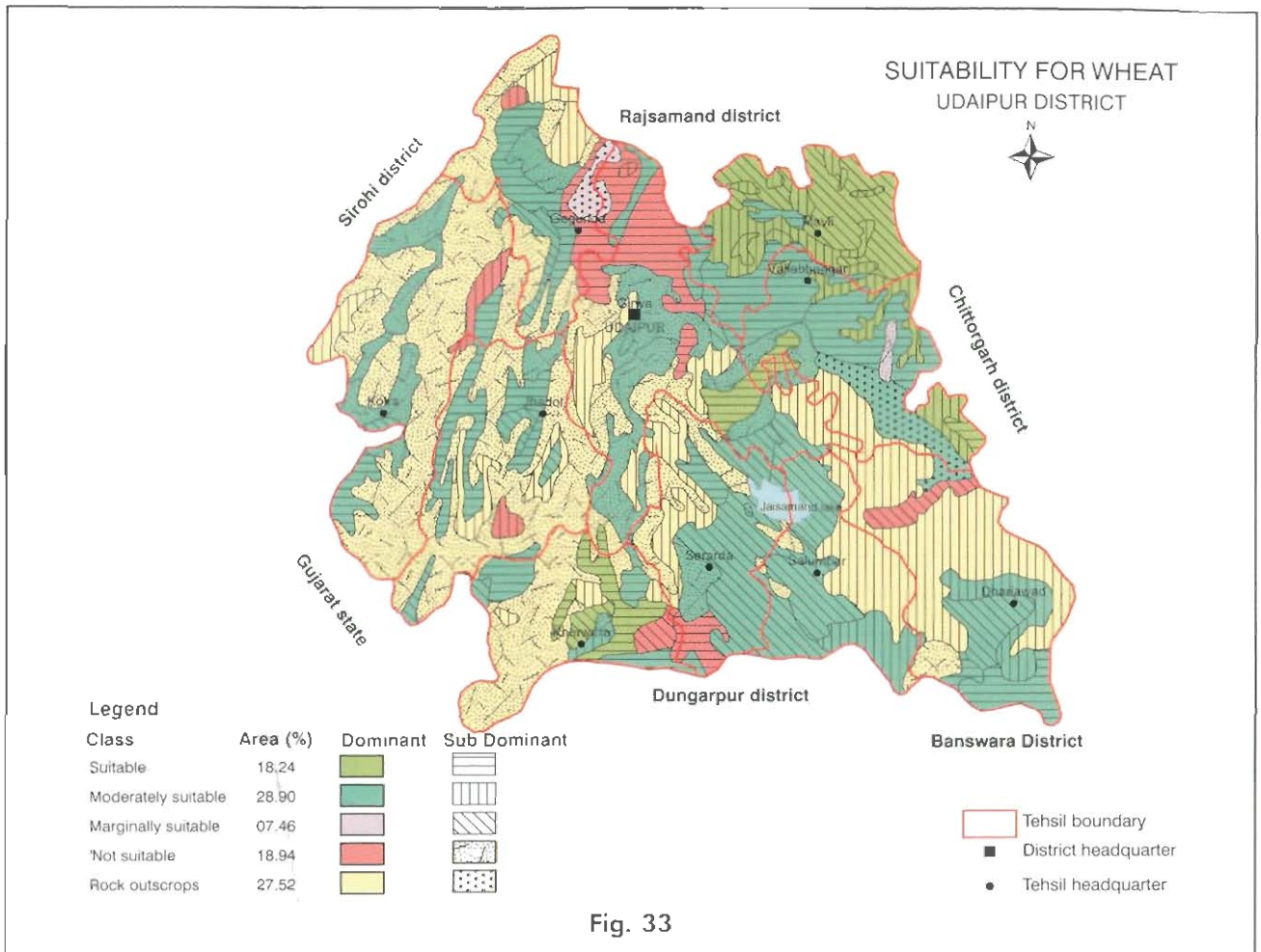
5.9 Suitability for wheat

In Udaipur district (Table 27 and Fig. 33) 18.2% and 28.9% area are suitable and moderately suitable for wheat subject to irrigation facility. In Aravalli physiographic region 40.1% area is suitable to moderately suitable as compared to 94.2% in ER upland. In Aravalli region only part of Dhariawad and Girwa tehsil are suitable for wheat. Suitability index for wheat is 32.8 in Aravalli and 70.1 in ER upland physiographic regions. Suitable soils for wheat is 56% in Mavli tehsil followed by 32% in Vallabhnagar and 24.8% in Kherwara tehsil. Moderately suitable area for wheat is 47-56% in Salumbar, Dhariawad and Vallabhnagar tehsil, 30-40% in Sarada and Girwa tehsil and 15 to 30% in Gogunda, Jhadol, Kherwara and Kotra tehsil. Marginally suitable area is 15-20% in Mavli, Salumbar and Sarada tehsil. Suitability index for wheat is high in Mavli (70.0) and Vallabhnagar tehsil (58.0), between 30-40 in Salumbar (60.1), Dhariawad, Gogunda, Kherwara, Sarada and Girwa tehsil and low in Kotra (20.8) and Jhadol (26.7) tehsil.

Dominant soils in valley portion of Kotra, Jhadol and Gogunda tehsil are moderately suitable for wheat associated with suitable soils. Dominant soils in valley portion of Girwa and Kherwara tehsil are moderately suitable. Dominant soils in Sarada, Salumbar and Dhariawad are moderately suitable for wheat associated with marginally suitable area. Southern part of Dhariawad tehsil adjoining Banswara district and Vallabhnagar and part of Mavli tehsil are associated with suitable soils for wheat. Dominant soils in northern part of Mavli tehsil in ER upland is suitable for wheat and associated with marginally suitable subdominant soils. Associated soils with rock outcrops in Salumbar and Dhariawad tehsil are moderately suitable for wheat.

Table 27. Suitability of soils of Udaipur district for wheat (Area in ha)

Tehsil	Suitability class				Suitability index
	Suitable	Moderate	Marginal	Not suitable	
Dhariawad	5683	57942	7791	6237	36.4
Gogunda	10168	24408	5152	22348	32.8
Jhadol	10713	34136	3143	37977	26.7
Kherwara	27296	17620	4633	25684	37.7
Kotra	6616	44974	1150	87013	20.8
Mavli	46493	19853	16373	193	70.0
Salumbar	0	85518	28276	2275	41.7
Sarada	12001	87131	35017	34912	36.6
Girwa	28991	57716	6068	56274	38.6
Vallabhnagar	33145	50494	1454	4035	58.0
Total (%)	266625 (18.24)	422551 (28.90)	109056 (7.46)	276946 (18.94)	37.8



5.10 Suitability for barley

In Udaipur district (Table 28 and Fig. 34) 15.1% and 30.5% geographical area are suitable and moderately suitable for barley. In Aravalli physiographic region 8.4% and 32.1% area are suitable and moderately suitable whereas in ER upland 88.6% area is suitable for barley. Suitability index for barley is 32.7 in Aravalli and 81.2 in ER upland physiographic regions. Suitable area for barley is 67.2% in Mavli and 56.3% in Vallabhnagar tehsil followed by 11-25% in Gogunda, Kherwara and Girwa tehsil. Moderately suitable area is 48-56% in Dhariawod and Salumbar tehsil, 25-40% in Sarada, Gogunda, Girwa and Vallabhnagar tehsil and 16-18% in Kherwara and Kotra tehsil. Marginally suitable area for barley is 15-20% in Mavli, Salumbar and Sarada tehsil. Suitability index is high in Mavli (72.8) and Vallabhnagar (64.6), 33 to 42 in Dhariawad, Gogunda, Kherwara, Salumbar, Girwa and Vallabhnagar tehsil and low in Kotra (20.3) and Jhadol (26.7) tehsil.

Soils of Mavli, northern part of Vallabhnagar and part of Kherwara tehsil are suitable for barley. Valley soils in Kotra, Jhadol and Gogunda tehsil are moderately suitable and associated with suitable soils for barley. Soils of Solumbar, Sarada and Dhariawad tehsil are moderately suitable and associated with marginally suitable sub dominant soils. Rock outcrops in Salumber and Dhariawad tehsil are

Table 30. Suitability of soils of Udaipur district for gram (Area in ha)

Tehsil	Suitability class				Suitability index
	Suitable	Moderate	Marginal	Not suitable	
Dhariawad	5683	57942	4977	9051	35.9
Gogunda	0	37264	2327	22484	30.6
Jhadol	0	42254	4009	39708	24.2
Kherwara	13003	30800	3159	28270	33.1
Kotra	0	50557	1494	87701	20.0
Mavli	40226	9355	14049	19281	59.4
Salumbar	0	72675	32557	10837	38.8
Sarada	268	48200	51904	68688	28.0
Girwa	6095	73160	6852	62943	34.1
Vallabhnagar	17333	45564	22195	4035	50.2
Total (%)	82608 (5.65)	467772 (31.99)	143523 (9.82)	352999 (24.14)	33.5

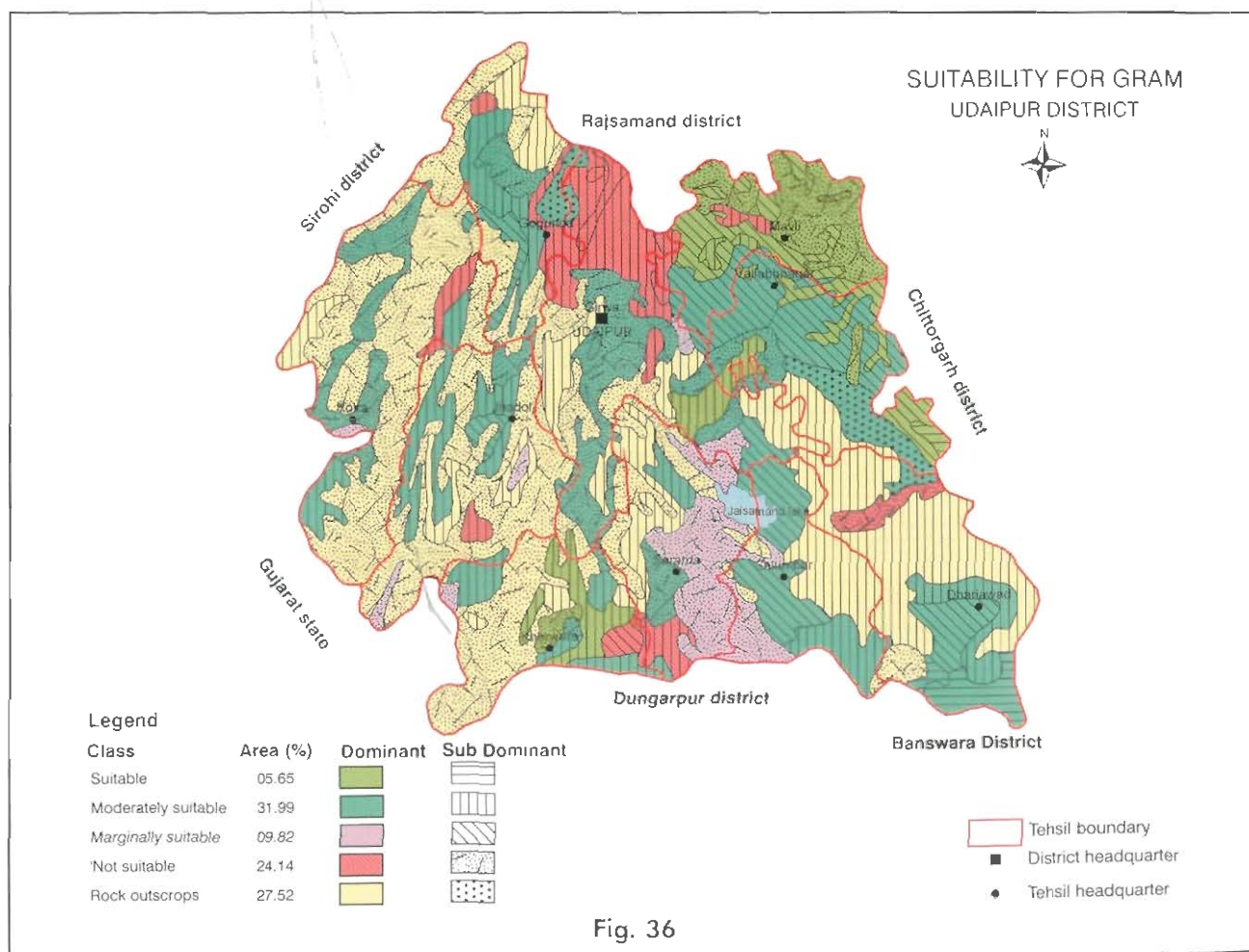
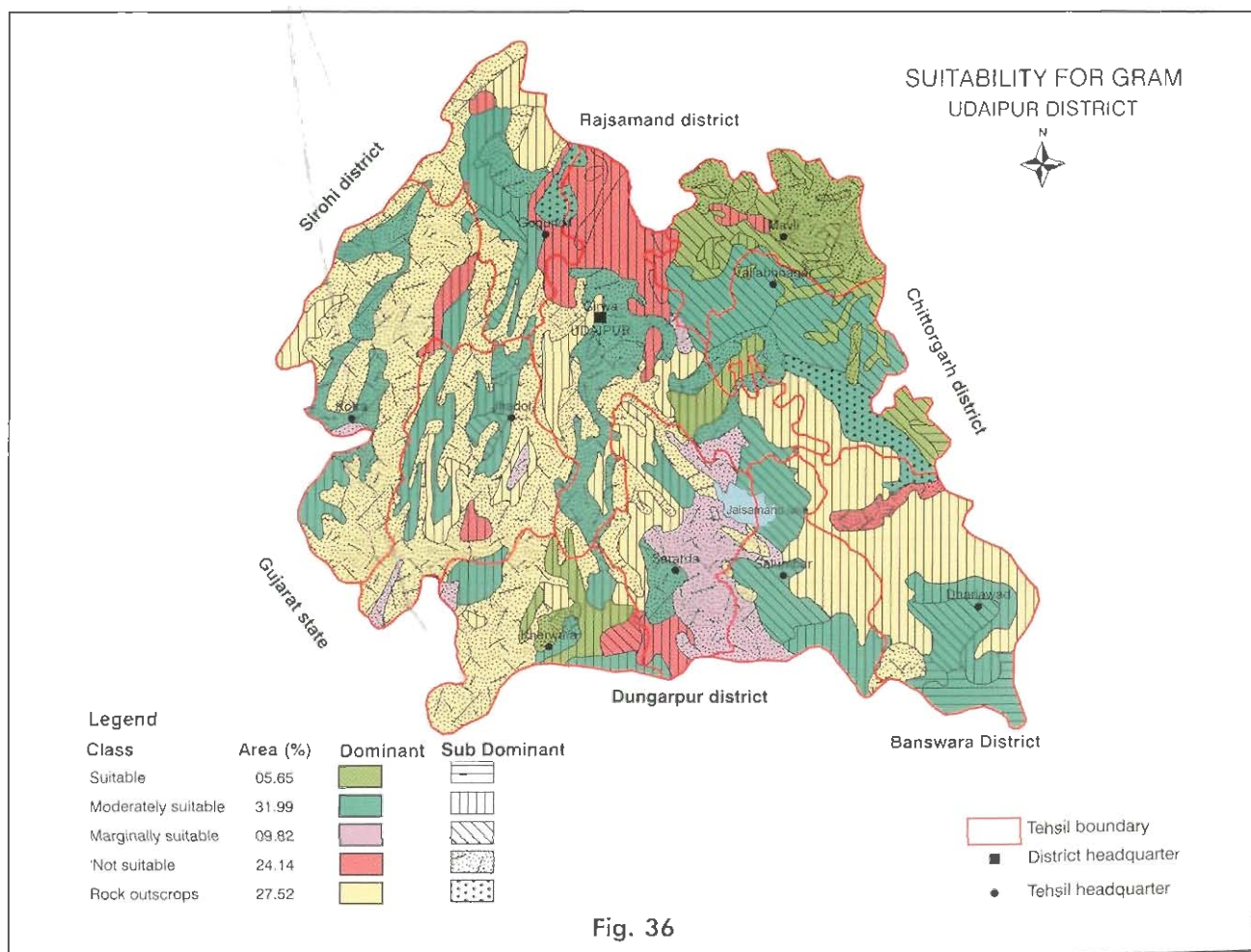


Table 30. Suitability of soils of Udaipur district for gram (Area in ha)

Tehsil	Suitability class				Suitability index
	Suitable	Moderate	Marginal	Not suitable	
Dhariawad	5683	57942	4977	9051	35.9
Gogunda	0	37264	2327	22484	30.6
Jhadol	0	42254	4009	39708	24.2
Kherwara	13003	30800	3159	28270	33.1
Kotra	0	50557	1494	87701	20.0
Mavli	40226	9355	14049	19281	59.4
Salumbar	0	72675	32557	10837	38.8
Sarada	268	48200	51904	68688	28.0
Girwa	6095	73160	6852	62943	34.1
Vallabhnagar	17333	45564	22195	4035	50.2
Total (%)	82608 (5.65)	467772 (31.99)	143523 (9.82)	352999 (24.14)	33.5



Dominant soils in northern part of Mavli tehsil are suitable for mustard. Part of Girwa and Dhariawad tehsil are suitable for mustard. Dominant soils in Gogunda and Jhadol tehsil are moderately suitable for mustard associated with suitable areas. Dominant soils in valley portions in Girwa and Jhadol tehsil are moderately suitable for mustard. Part of Sarada, Salumbar and Dhariawad tehsil have moderately suitable dominant soils and marginally suitable subdominant soils for mustard. Subdominant soils of northern portions of Girwa tehsil is suitable for mustard. Associated soils with rock outcrop in Salumbar and Dhariawad tehsil are moderately suitable.

Table 29. Suitability of soils of Udaipur district for mustard (Area in ha)

Tehsil	Suitability class				Suitability index
	Suitable	Moderate	Marginal	Not suitable	
Dhariawad	5683	57942	7791	6237	35.1
Gogunda	10168	27233	2327	22348	33.5
Jhadol	10713	34136	3143	37977	26.7
Kherwara	27296	17620	4633	25684	37.0
Kotra	6616	44974	1150	87013	20.8
Mavli	42165	24181	16373	193	68.6
Salumbar	0	85518	28276	2275	41.7
Sarada	12001	87131	35017	34912	36.7
Girwa	28110	59915	4757	56274	38.7
Vallabhnagar	22374	62718	969	3066	55.9
Total (%)	165127 (11.29)	501368 (34.29)	104436 (7.14)	275977 (18.88)	36.5

5.12 Suitability for gram

In Udaipur district (Table 30 and Fig. 36) 5.7% and 32.0% area are suitable and moderately suitable for gram. In Aravalli region 5.9% and 31.2% area are suitable and moderately suitable for gram whereas in ER upland 17.8% and 41.4% area is suitable and moderately suitable for gram. Suitability index is 30.9 in Aravalli and 53.4 in ER upland physiographic region. Suitable area for gram is 48.5% in Mavli tehsil and 11 to 17% in Kherwara and Vallabhnagar tehsil. Moderately suitable area is 38-50% in Dhariawad, Girwa, Gogunda, Salumbar and Vallabhnagar tehsil and 20-30% in Jhadol, Kherwara, Kotra and Sarada tehsil. Marginally suitable area is 16-22% in Salumbar, Sarada and Vallabhnagar tehsil. Suitability index is high in Mavli (59.4) and Vallabhnagar (50.2), between 30 to 40 in Dhariawad, Gogunda, Kherwara, Salumbar and Girwa tehsil and low in Jhadol, Kotra and Sarada tehsil.

Dominant soils in northern part of Mavli tehsil are suitable for gram. Part of Girwa and Kherwara tehsil have dominant soils suitable for gram associated with moderately suitable soils. Valley portion in Jhadol and Gogunda tehsil have moderately suitable soils. Dominant soils in valley portion in Kotra and Girwa tehsil are moderately suitable for gram. Associated soils with rock outcrops in Salumbar and Dhariawad tehsil have moderately suitable soils. Northern portion of Vallabhnagar and southern part of Dhariawad tehsil have moderately suitable dominant soils for gram associated with marginally suitable soils.

SUITABILITY FOR COTTON (IRRIGATED) UDAIPUR DISTRICT

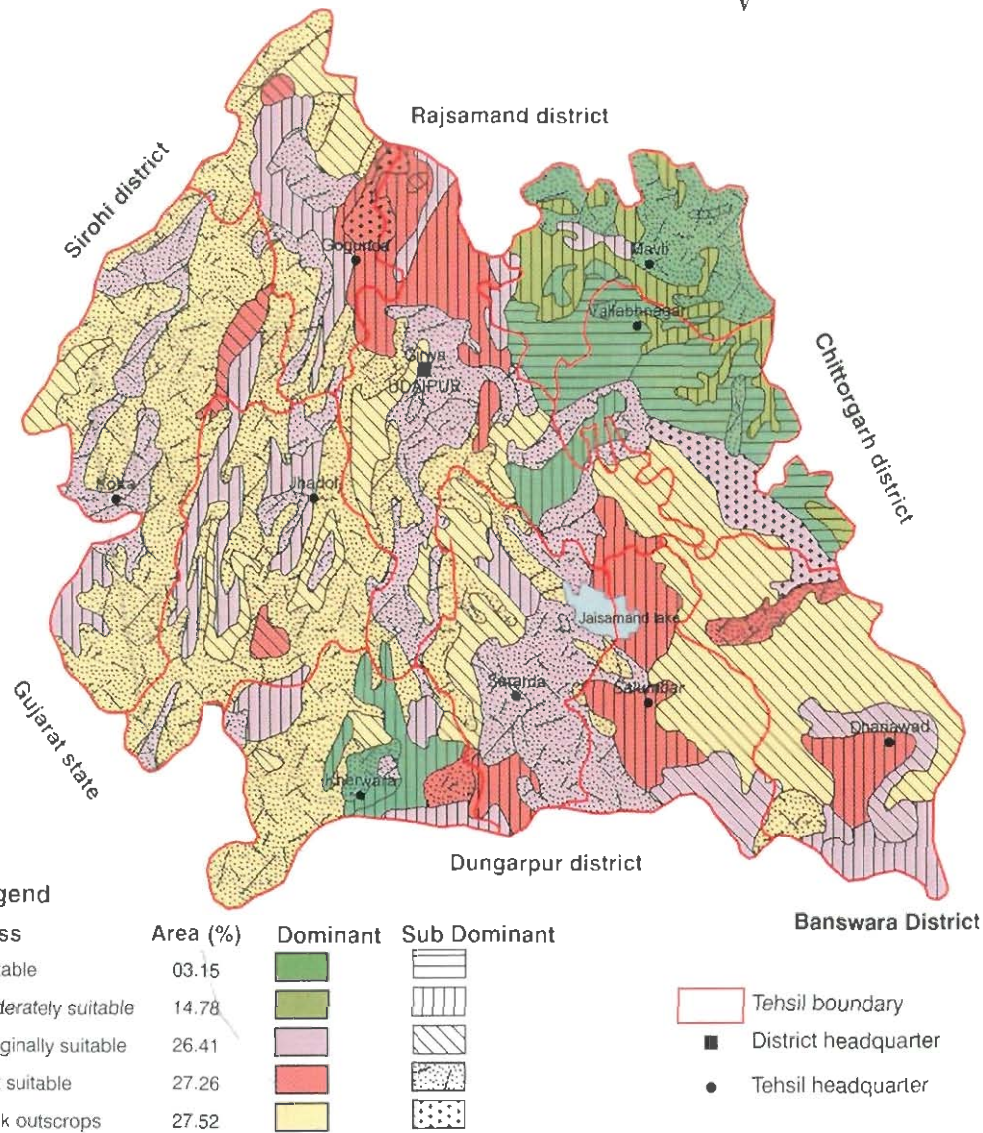


Fig. 37

5.13 Suitability for cotton

In Udaipur district (Table 31 and Fig. 37) 3.2% and 14.8% area are suitable and moderately suitable for cotton predominantly in ER physiographic region in Mavli and Vallabhnagar tehsil. In Aravalli region 11.6% soils are moderately suitable whereas in ER upland 48.3% and 37.4% of soils are suitable and moderately suitable respectively for cotton with suitability index of 23.7 and 68.2. Suitable soils for cotton is only in Mavli (22.6%) and Vallabhnagar tehsil. Moderately suitable area for cotton is predominantly in Mavli (54.0%), Vallabhnagar (43.8%) and Kherwara tehsil (28%) and in pockets in Gogunda (11.2%), Salumbar (13.0%) and Girwa (16.8%) tehsil. Marginally suitable area for cotton is in Dhariawad (41.7%), Salumbar (37%), Sarada (37.0%) and Gogunda (23.7%) tehsil. Suitability index for cotton is high in Mavli (57.0) and Vallabhnagar (52.9), between 20-30 in Dhariawad, Gogunda, Kherwara, Salumbar, Sarada and Girwa tehsil and low in Kotra (16.4) and Jhadol (19.6) tehsil.

In northern part of Mavli tehsil dominant soils are moderately suitable whereas northern part of Vallabhnagar and southern part of Mavli have moderately suitable dominant soils associated with suitable subdominant soils for cotton. Part of Kherwara has moderately suitable area for cotton. Subdominant soils in valley portion in Jhadol and Gogunda and southern part of Dhariawad tehsil have moderately suitable soils for cotton.

Table 31. Suitability of soils of Udaipur district for cotton (Area in ha)

Tehsil	Suitability class				Suitability index
	Suitable	Moderate	Marginal	Not suitable	
Dhariawad	0	10660	50478	16516	24.7
Gogunda	0	10168	24408	27500	23.5
Jhadol	0	10713	34136	41121	19.6
Kherwara	0	29803	15113	30316	27.2
Kotra	0	6616	44974	88162	16.4
Mavli	18729	44781	2837	16565	57.0
Salumbar	0	19714	55948	40408	27.9
Sarada	0	12962	85689	70409	24.6
Girwa	881	31761	52899	63507	28.4
Vallabhnagar	26515	38965	19612	4035	52.9
Total (%)	46125 (3.15)	216143 (14.78)	386093 (26.41)	398540 (27.26)	29.2

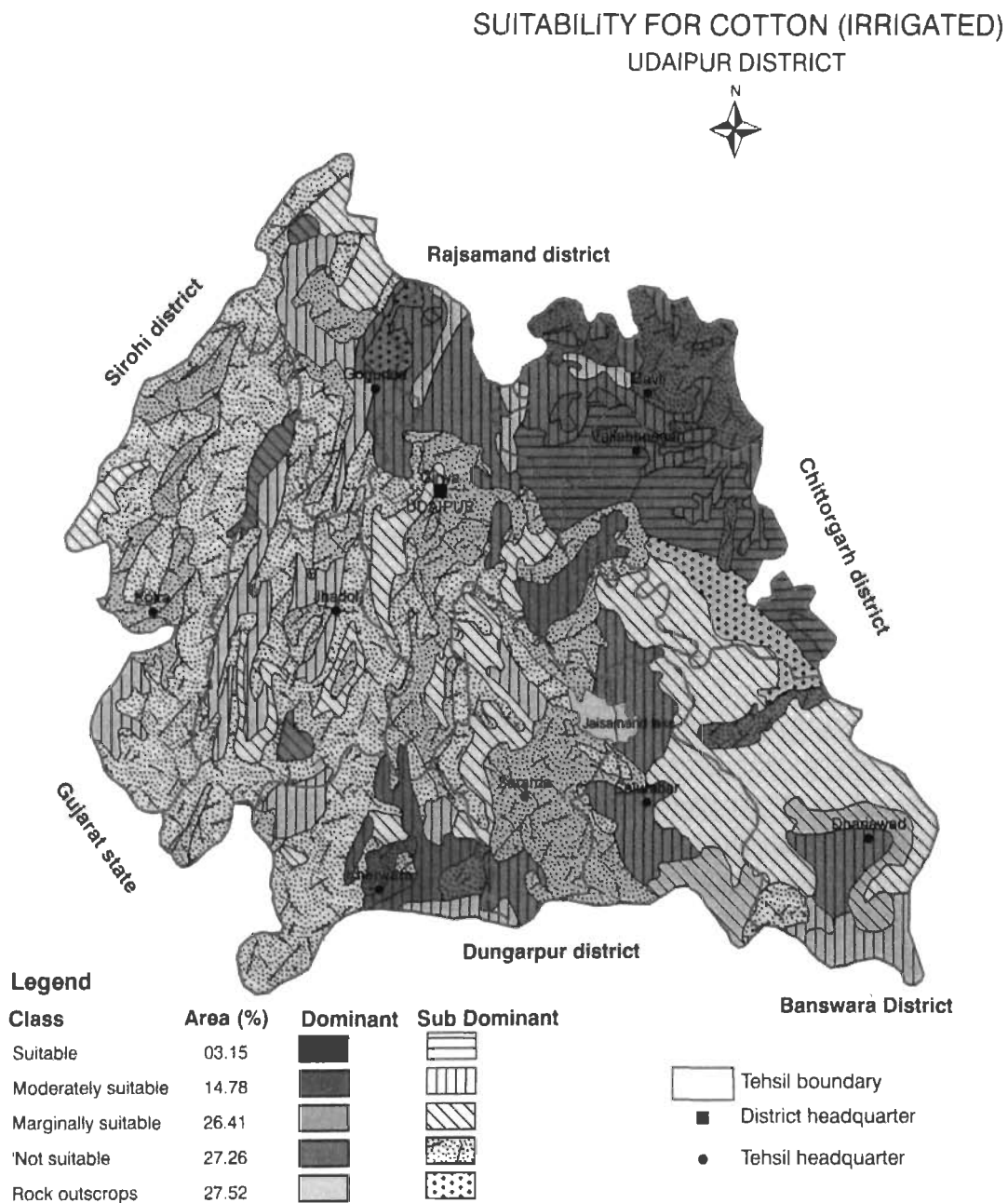


Fig. 37

CROP PLANNING

6.1 Present Scenario

Average of land use for the period 1991-2000 of Udaipur district indicates net sown area of 2.44 lakh ha which constitutes 16.7% area of TGA. Double cropped area and net irrigated area constitute 44.7 and 37.6% of net sown area. During kharif major crops are maize (66.8%), pulses (9.0%), sorghum (4.2%), rice (4.8%). During rabi major crops are wheat (25.7%), barley (5.0%), gram (10.5%). Average productivity for maize, rice, groundnut, bajra, sesame and sorghum is 616, 463, 590, 305, 310 and 312 kg ha⁻¹. During rabi average productivity for wheat, barley, mustard and gram is 2267, 1819, 1374 and 1165 kg ha⁻¹.

6.2 Crop potential

In Udaipur district maize is principal traditional crop being cultivated in 1.63 lakh ha (Table 32). The potentially suitable and moderately suitable area for maize is 2.87 lakh ha. Sorghum is cultivated only in ten thousand ha. The potentially suitable area for sorghum is almost twice as compared to maize. Similarly potential suitable area for oilseed crops (castor and sunflower) and pulses is almost thrice as compared to maize. This indicates the possibility of introducing oilseeds and pulses in culturable waste and fallow (2.17 lakh ha). Sesame can also be introduced in part of uncultivable waste. Introduction of these crops can increase cropped area substantially from the present 16.7%. In view of limited irrigation facility in the district (92 thousand ha) there is not much scope for increasing the area in rabi. However, there can be shift from wheat to barley, mustard, gram and rabi pulses which have low water requirement as compared to wheat. Thus, there is possibility of increasing cropped area during rabi. Suitability index for sorghum, oilseed and pulses is higher as compared to maize. During rabi suitability index for all the crops is almost similar.

Table 32. Crop potential in Udaipur district

Crop	Area(ha.)	(%) crop area	Potential area (ha)		Suitability index	Yield (kg/ha) (Av 91-2000)
			S1	S1+S2		
Maize	163247	66.80	90940	286840	29.6	616
Sorghum	10216	4.18	215920	594080	36.3	312
Bajra	31	0.013	–	195320	25.7	305
Sesame	4068	1.66	–	739940	35.1	310
Castor	1083	0.44	158260	623040	35.0	–
Sunflower	–	–	423180	704480	41.7	–
Beans	–	–	488980	644720	42.1	–
Cowpea	21898	8.96	249120	621140	37.3	–
Rice	11843	4.85	–	–	–	463
Groundnut	5095	2.08	–	–	–	590
Wheat	62871	25.73	188326	680700	38.6	2267
Barley	12344	5.05	365620	787980	38.6	1819
Mustard	11216	4.59	153900	687980	36.5	1374
Gram	25767	10.54	106940	579680	33.5	1165
Cotton	85	0.03	–	132040	24.8	–

6.3 Future thrust

In Udaipur district major portion of potentially suitable area for cultivation is in valley portions of Jhadol, Gogunda and Girwa tehsil, Mavli and Vallabhnagar tehsil and southern part of Dhariawad, Salumbar and Kherwara tehsil. Associated soils with rock outcrops in Salumbar and Dhariawad tehsil are moderate to marginally suitable for crops. Introduction of oilseeds and pulses in moderate to marginally suitable area can substantially increase cropped area in the district. In valley soils in Jhadol and Gogunda tehsil there is possibility of augmenting water resources through watershed development and creating water storage structures. Besides cropping there is possibility of introducing medicinal plants in this region in view of suitable micro environment. In southern part of Dhariawad and Salumbar tehsil horticultural crops can be introduced with development of infrastructure and marketing facilities. Productivity of shallow skeletal soils can be enhanced by introduction of grasses namely Dhaman (*Cenchrus* spp) and Karad (*Dicanthium annulatum*). Development of shallow skeletal soils as pastures will help in enhancing animal husbandry and dairy activity and help in increasing income level of tribal population.

Rock outcrops which constitutes 27.5% area of the district has the potential of runoff towards low lying cultivable areas. Development of pastures and plantation in pockets in these areas can substantially increase the water retention, recharge and augment water level. About 26.4% area of the district is under forest. Rejuvenation of forest areas is essential through plantation. Pasture lands which constitutes 6.4% area is mainly in degraded form. Reseeding of pasture land is essential to improve the vegetal cover and productivity.

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